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Sato

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(54) **IMAGE FORMING APPARATUS PROVIDED WITH PROCESS CARTRIDGE AND TONER CARTRIDGE DETACHABLY MOUNTABLE THEREIN**

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G03G 21/18 (2006.01)

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CPC ***G03G 21/1817*** (2013.01); ***G03G 15/0839*** (2013.01)

(58) **Field of Classification Search**
CPC G03G 21/18; G03G 15/0839
See application file for complete search history.

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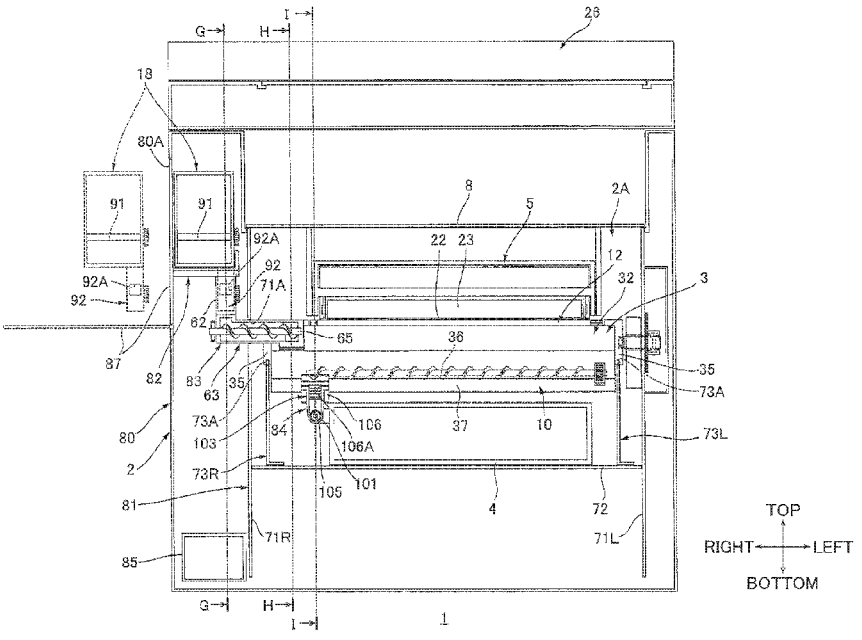
(57) **ABSTRACT**

An image forming apparatus includes: a main casing including a cover; a process cartridge including a second toner conveying part; a transfer belt; a toner cartridge including a first toner conveying part; a secondary transfer member; and a fixing unit. The cover opens and closes an opening of the main casing by pivotally moving about a pivot axis. The transfer belt and toner cartridge are positioned upward of the process cartridge. The secondary transfer member contacts the one end of the transfer belt. The pivot axis and fixing unit are closer to the one end than to the other end of the transfer belt in the orthogonal direction. The second toner conveying part has a second opening in communication with a first opening of the first toner conveying part. The second opening is opposite the developing roller with respect to the photosensitive drum in the orthogonal direction.

14 Claims, 12 Drawing Sheets



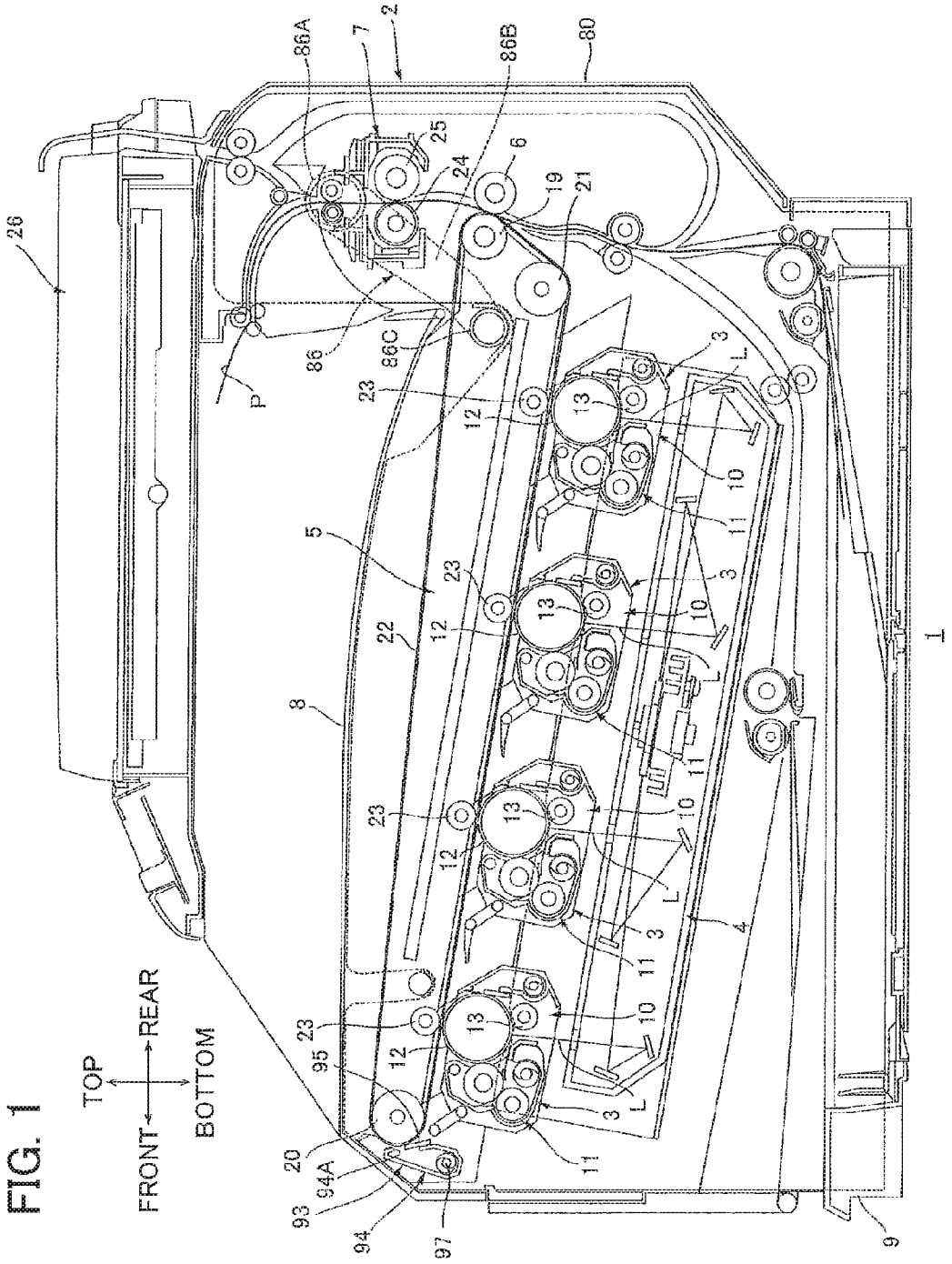

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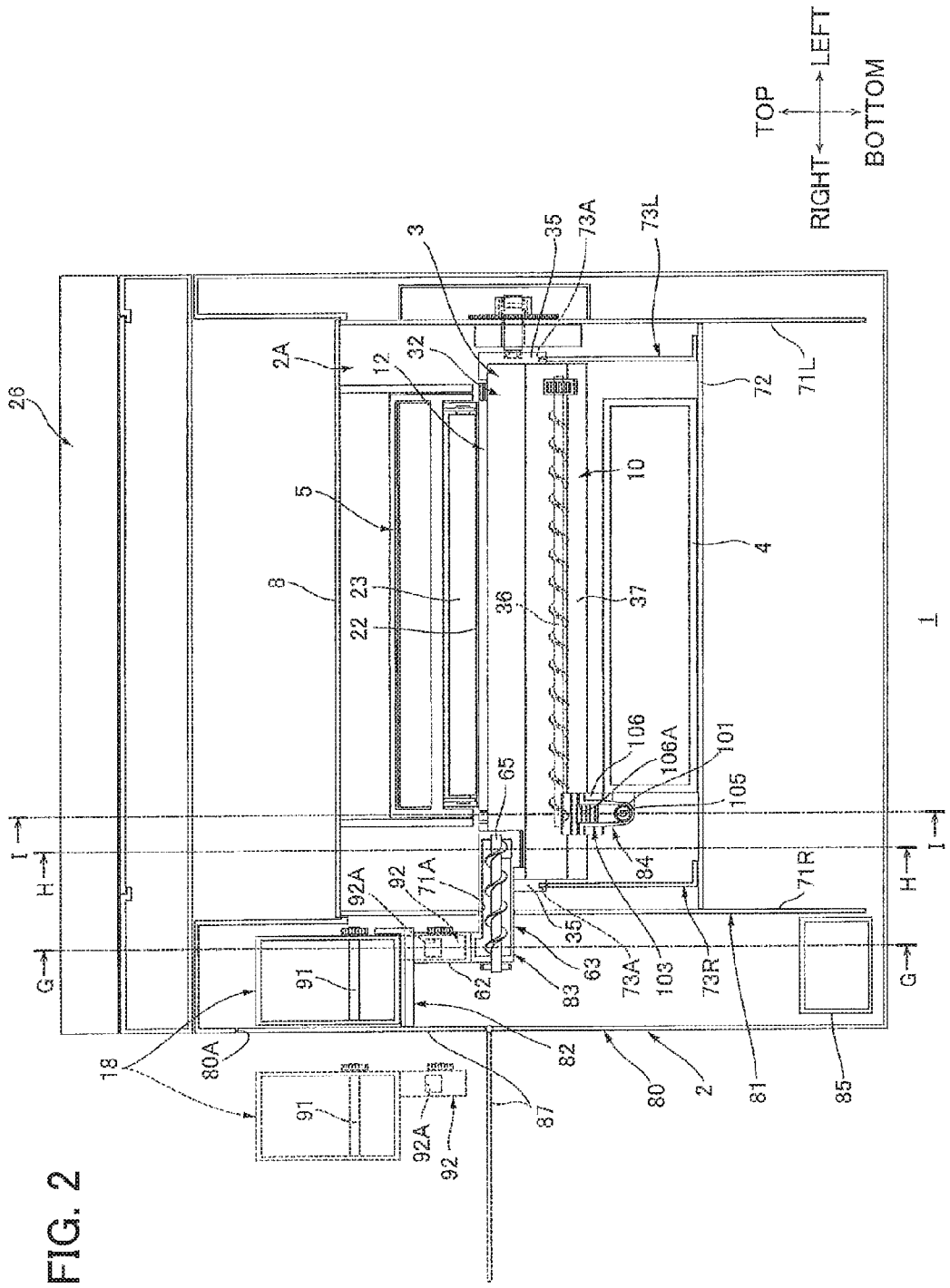
FIG. 1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71R
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73A
73L
73R
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80A
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106A
G
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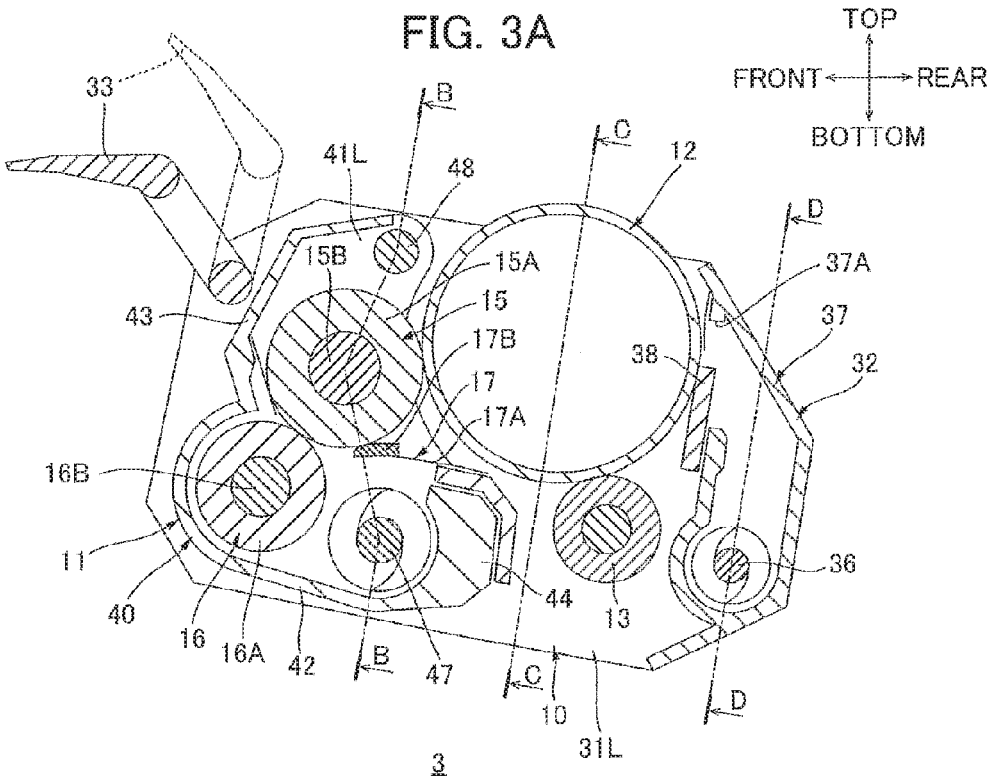
FIG. 2

FIG. 3A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C
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15B
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32
17
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16
16A
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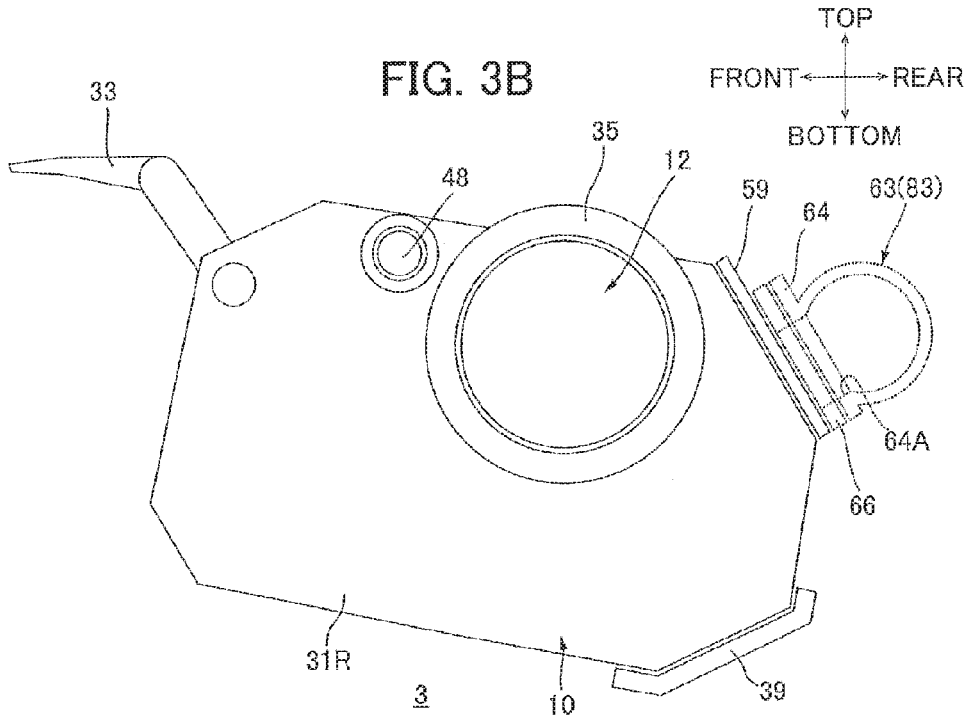
47
C
10
D
31L
3

FIG. 3B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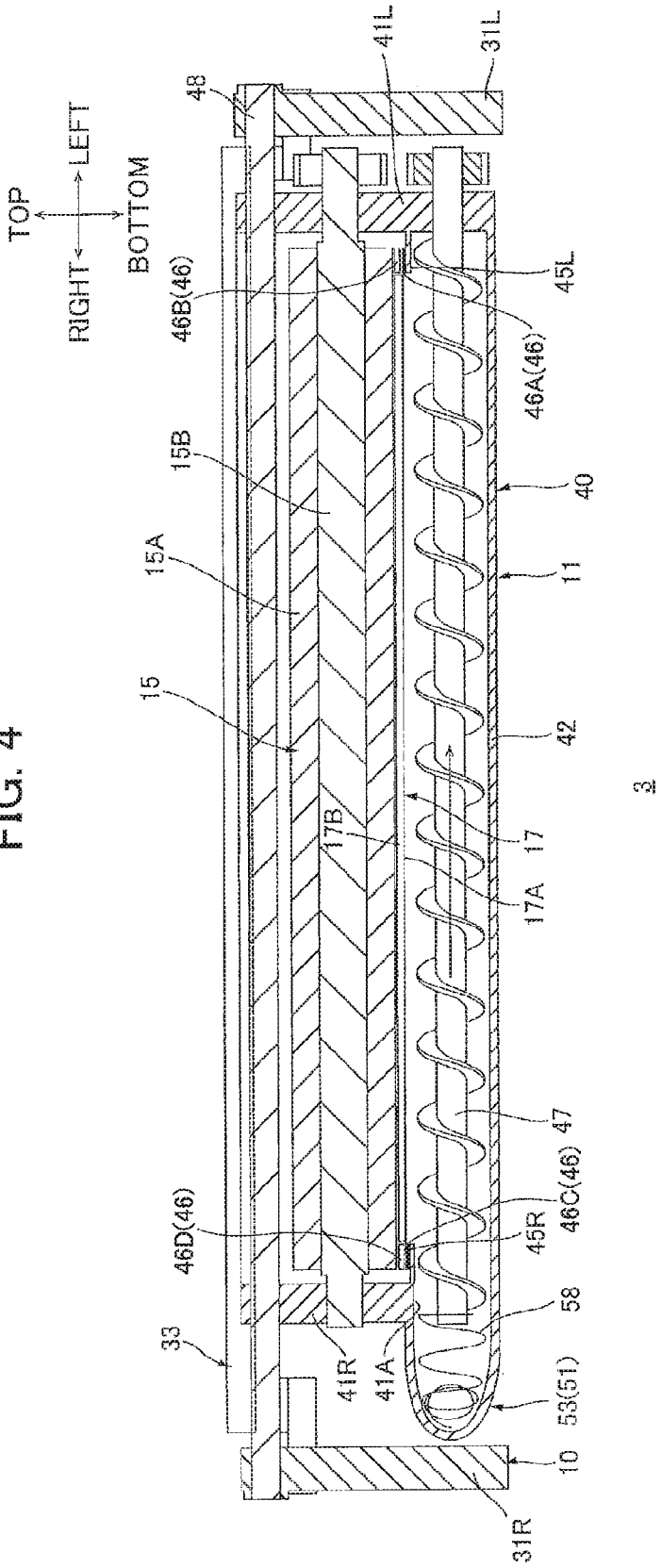
33
35
12
48
59
64
63(83)
64A
66
31R
3
10
39

FIG. 4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17B
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17A
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46C(46)
46D(46)
45R
58
33
41R
41A
53(51)
10
31R

FIG. 5

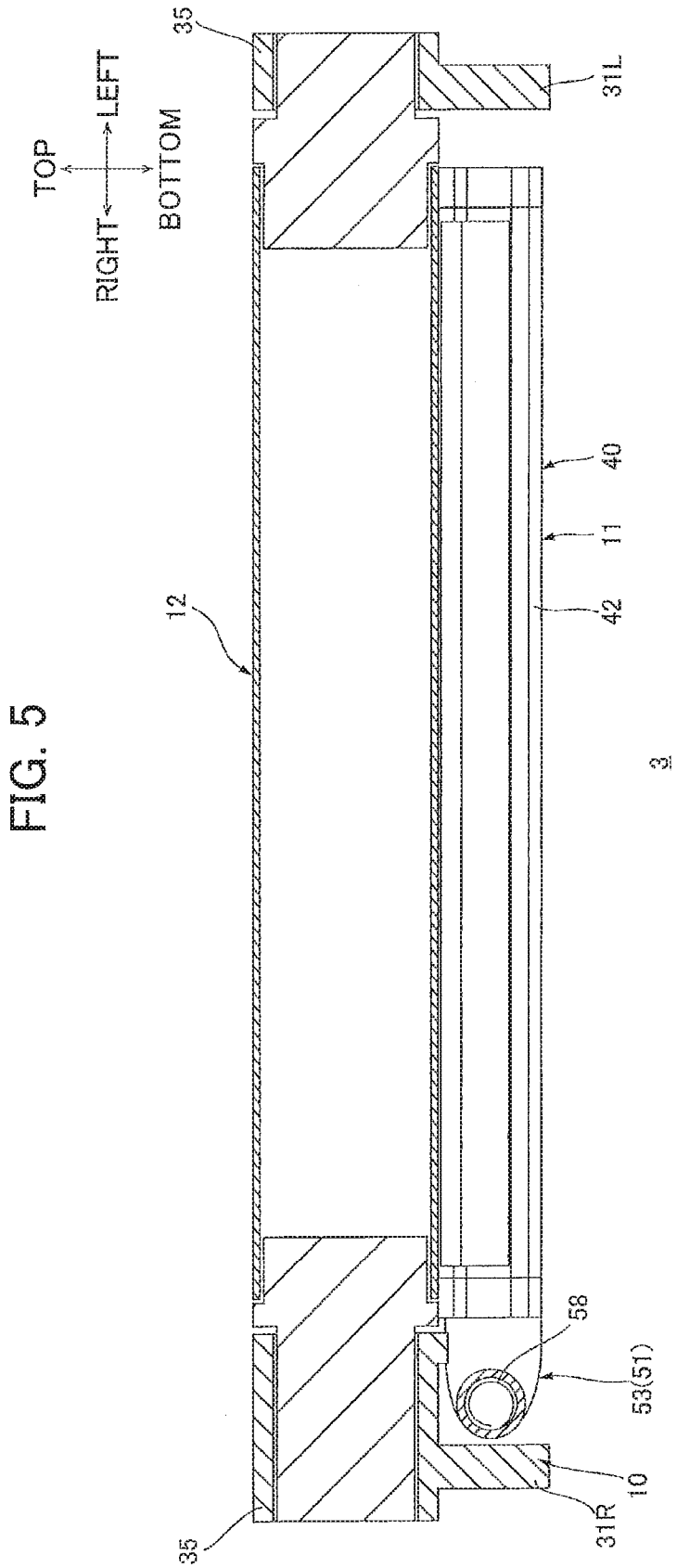
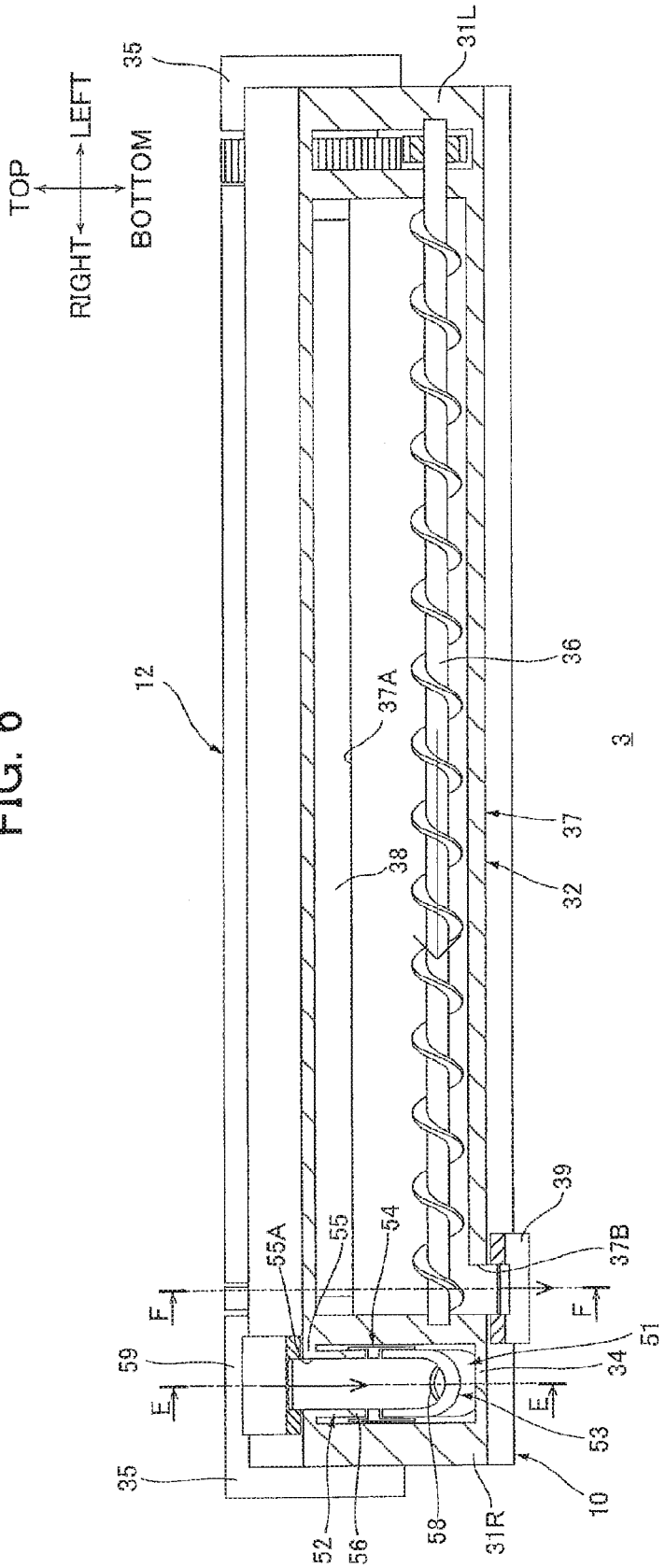


FIG. 6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51
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E
E
53
35
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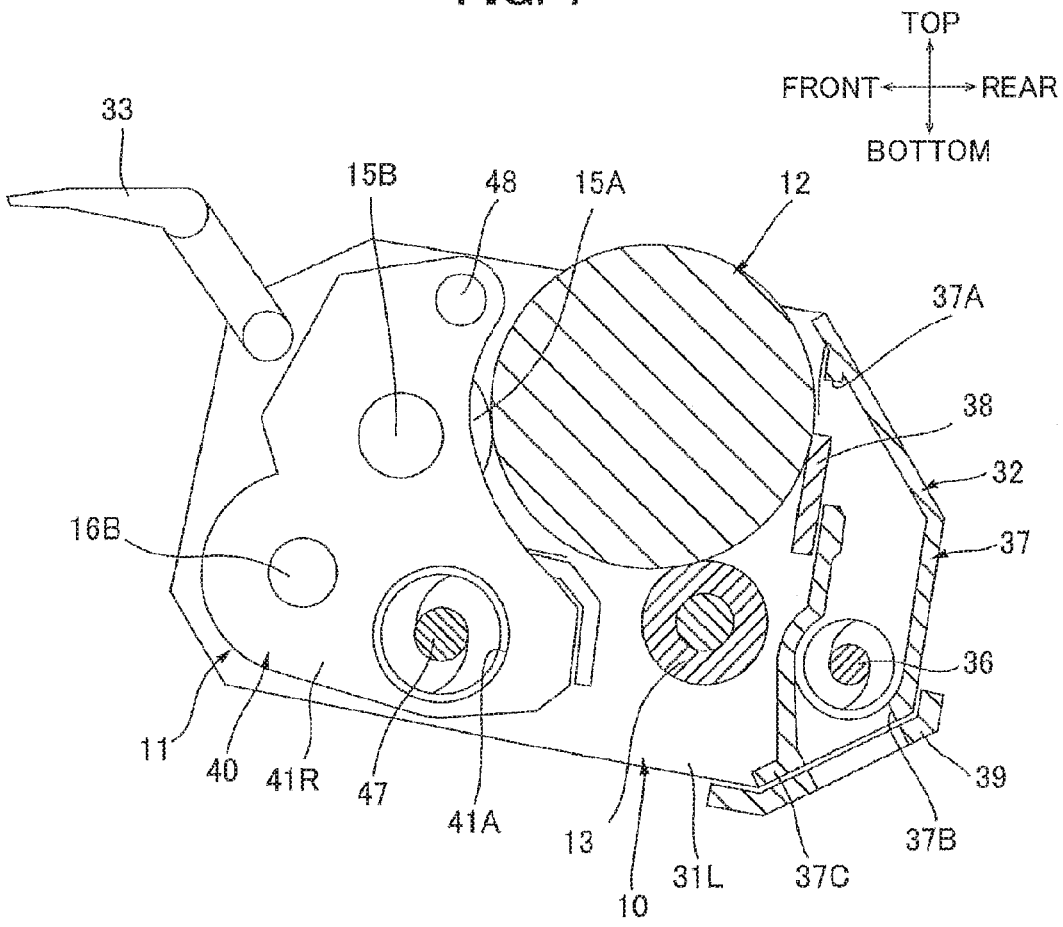
58
31R

FIG. 7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37A
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32
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16B
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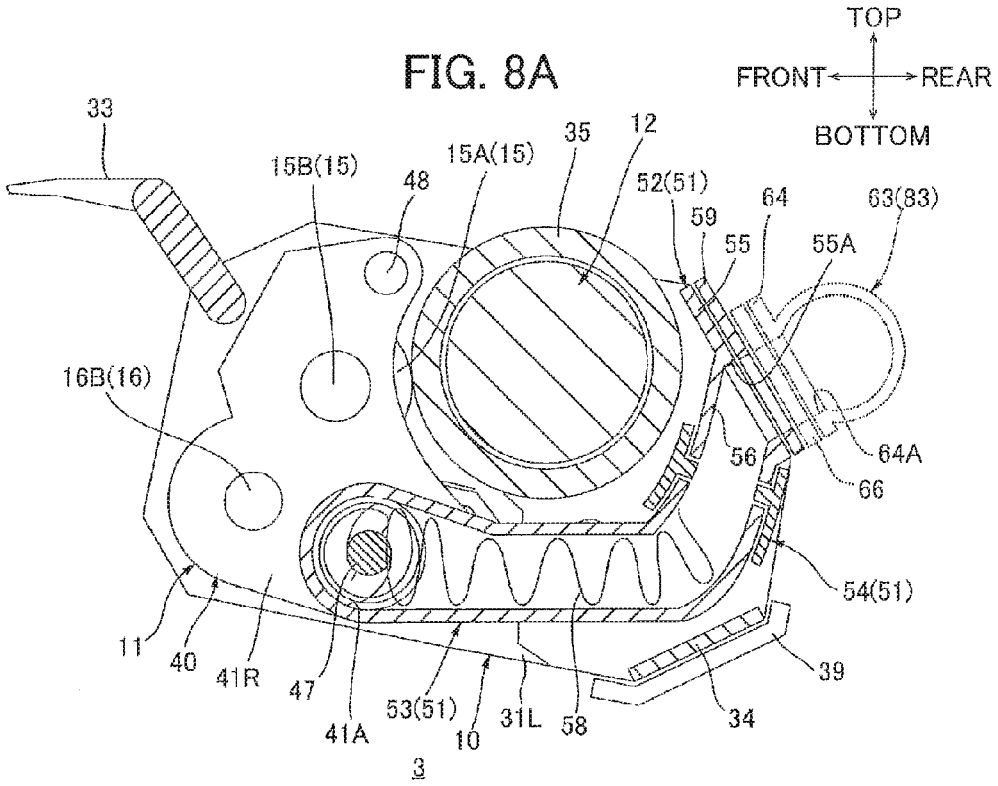
41R
47
41A
13
10
31L
37C
37B
39
3

FIG. 8A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15A(15)
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12
52(51)
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63(83)
55
55A
16B(16)
56
64A
66
54(51)
11
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41R
47
41A
53(51)
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31L
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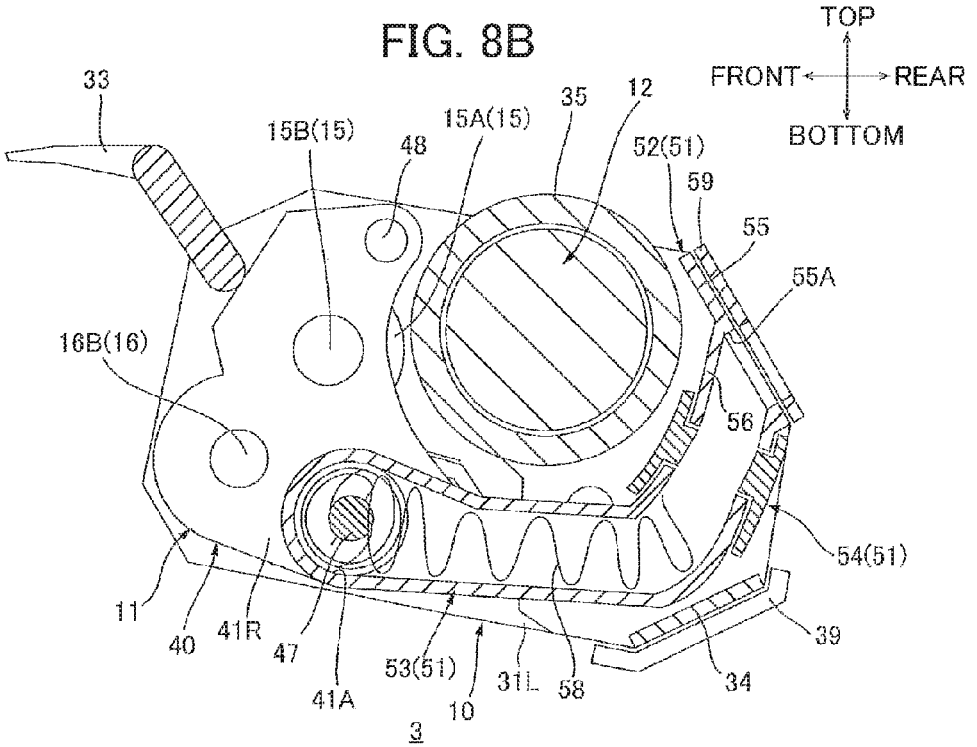
34
39
3

FIG. 8B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41A
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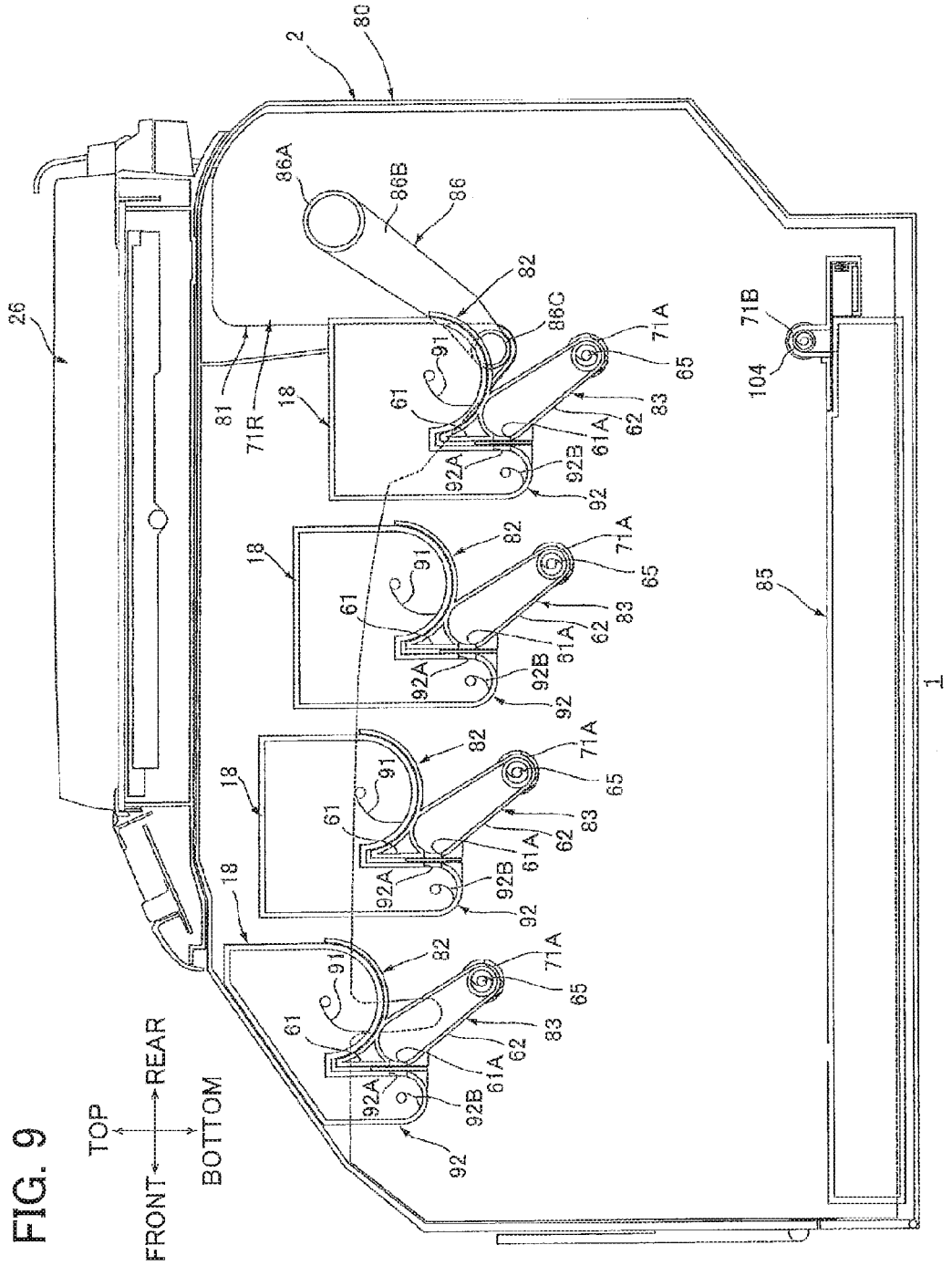
2
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86B
86
82
86C
71A
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71B
104
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81
71R
18
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FIG. 9

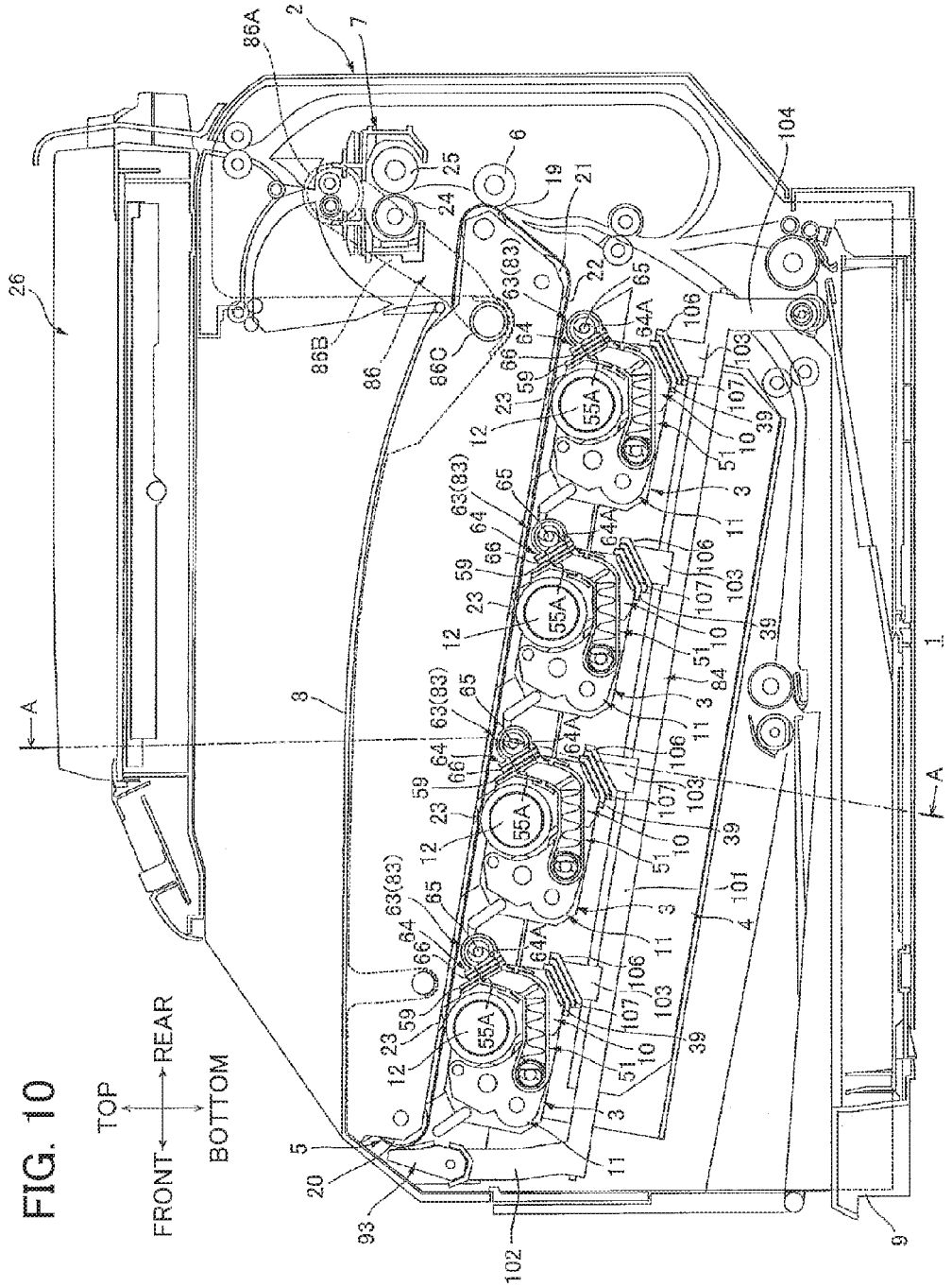


FIG. 10

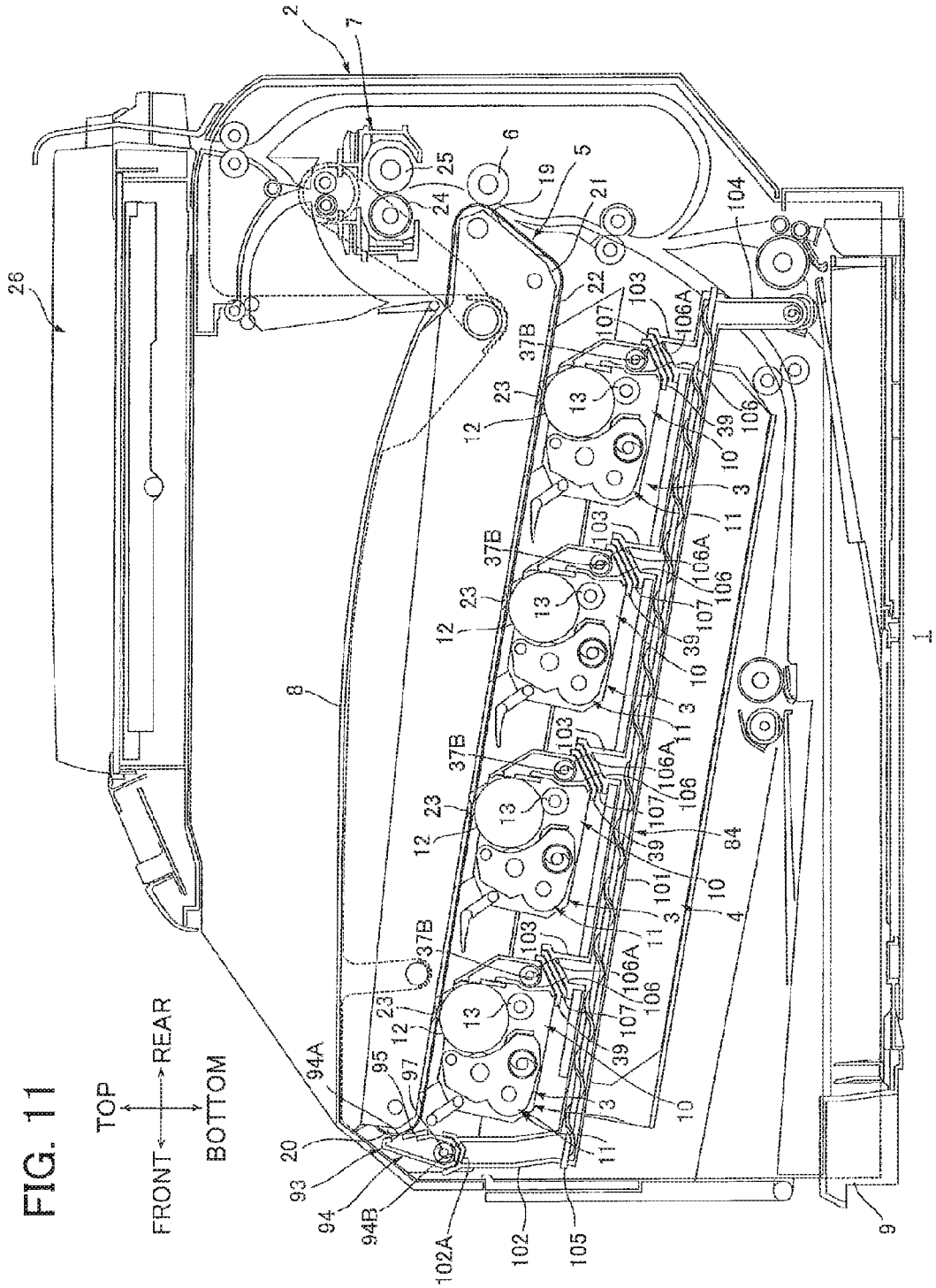
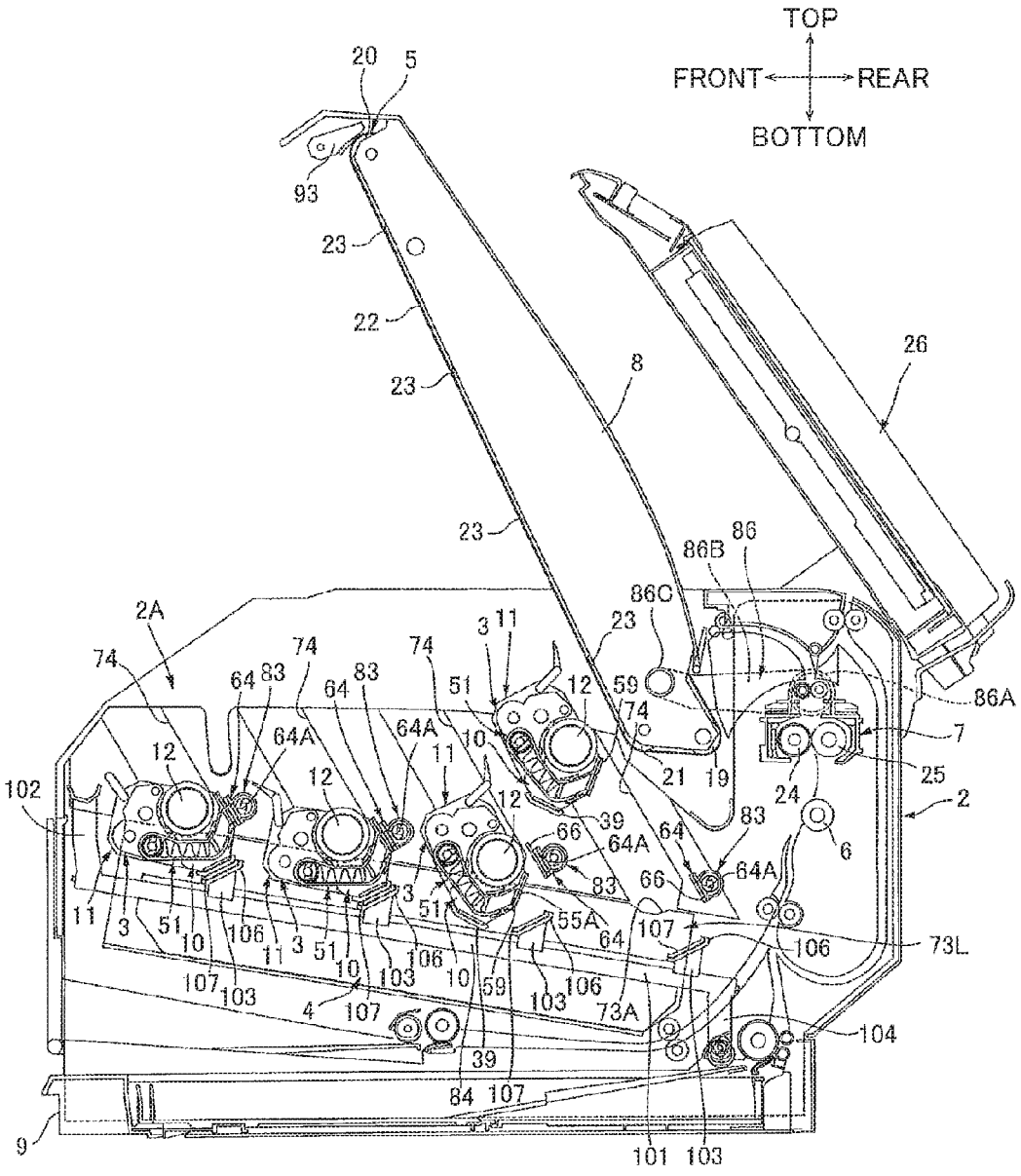


FIG. 11

FIG. 12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1

IMAGE FORMING APPARATUS PROVIDED WITH PROCESS CARTRIDGE AND TONER CARTRIDGE DETACHABLY MOUNTABLE THEREIN

CROSS REFERENCE TO RELATED APPLICATION

This application claims priority from Japanese Patent Application No. 2015-073409 filed Mar. 31, 2015. The entire content of the priority application is incorporated herein by reference.

TECHNICAL FIELD

The present disclosure relates to an electrophotographic type image forming apparatus, and a process cartridge mountable in the image forming apparatus.

BACKGROUND

An intermediate transfer type image forming apparatus has been known as an electrophotographic type image forming apparatus. The intermediate transfer type image forming apparatus includes a process cartridge provided with a photosensitive drum, and a transfer belt in contact with the photosensitive drum. A toner image formed on the surface of the photosensitive drum is transferred onto the transfer belt, and then the toner image is transferred onto a sheet from the transfer belt.

As such a type of image forming apparatus, there has been proposed an image forming apparatus including a process kit provided with a photosensitive drum and a developing unit, an intermediate transfer belt positioned on the process kit, a toner container positioned beside the intermediate transfer belt and accommodating toner to be supplied to the developing unit, a secondary transfer roller in contact with a front end portion of the intermediate transfer belt, and a fixing unit positioned above the secondary transfer roller.

This image forming apparatus is configured to remove the process kit from the apparatus in a diagonally upward and forward direction by upwardly retracting the intermediate transfer belt away from the process kit after the fixing unit and the secondary transfer roller are retracted forward away from the intermediate transfer belt.

SUMMARY

In view of the foregoing, it is an object of the disclosure to provide an improved image forming apparatus and a process cartridge mountable in the image forming apparatus.

In order to attain the above and other objects, according to one aspect, the disclosure provides an image forming apparatus including: a main casing; a process cartridge; a transfer belt; a toner cartridge; a secondary transfer member; a fixing unit; a first toner conveying part; and a second toner conveying part. The main casing has an opening. The main casing includes a cover configured to pivotally move about a pivot axis to open and close the opening. The process cartridge is detachably mountable in the main casing. The process cartridge includes a photosensitive drum and a developing roller. The transfer belt is positioned upward of the process cartridge and in contact with the photosensitive drum when the process cartridge has been mounted in the main casing. The transfer belt has one end and another end in an orthogonal direction orthogonal to a vertical direction and an axial direction of the photosensitive drum. The pivot axis is positioned closer to the one end of the transfer belt than to the another end of the transfer belt in the orthogonal direction. The toner cartridge is configured to accommodate toner to be supplied to the process cartridge and detachably mountable in the main casing. The toner cartridge is positioned upward of the process cartridge when the process cartridge and the toner cartridge have been mounted in the main casing. The secondary transfer member is in contact with the one end of the transfer belt. The fixing unit includes a heating body and a pressure body. The fixing unit is positioned closer to the one end of the transfer belt than to the another end of the transfer belt in the orthogonal direction. The first toner conveying part is provided at the toner cartridge and has a first opening. The second toner conveying part is provided at the process cartridge and has a second opening configured to communicate with the first opening. The second opening is positioned opposite the developing roller with respect to the photosensitive drum in the orthogonal direction.

According to another aspect, the disclosure provides a process cartridge detachably mountable in an image forming apparatus and including a developing roller and a photosensitive drum. The image forming apparatus includes: a main casing; a transfer belt; a toner cartridge; a secondary transfer member; and a fixing unit. The main casing has an opening. The main casing includes a cover configured to pivotally move about a pivot axis to open and close the opening. The transfer belt is positioned upward of the process cartridge and in contact with the photosensitive drum when the process cartridge has been mounted in the main casing. The transfer belt has one end and another end in an orthogonal direction orthogonal to a vertical direction and an axial direction of the photosensitive drum. The pivot axis is positioned closer to the one end of the transfer belt than to the another end of the transfer belt in the orthogonal direction. The toner cartridge is configured to accommodate toner to be supplied to the process cartridge and detachably mountable in the main casing. The toner cartridge is positioned upward of the process cartridge when the process cartridge and the toner cartridge have been mounted in the main casing. The toner cartridge includes a first toner conveying part having a first opening. The secondary transfer member is in contact with the one end of the transfer belt. The fixing unit includes a heating body and a pressure body. The fixing unit is positioned closer to the one end of the transfer belt than to the another end of the transfer belt in the orthogonal direction. The process cartridge is detachably mountable in the main casing and further includes a second toner conveying part having a second opening. The second opening is configured to communicate with the first opening and positioned opposite the developing roller with respect to the photosensitive drum.

BRIEF DESCRIPTION OF THE DRAWINGS

The particular features and advantages of the embodiment(s) as well as other objects will become apparent from the following description taken in connection with the accompanying drawings, in which:

FIG. **1** is a central cross-sectional view of an image forming apparatus according to one embodiment;

FIG. **2** is a cross-sectional view of the image forming apparatus shown in FIG. **1** and taken along a line A-A in FIG. **10**;

FIG. **3**A is a central cross-sectional view of a process cartridge provided in the image forming apparatus shown in FIG. **1**;

FIG. **3**B is a right side view of the process cartridge shown in FIG. **3**A;

FIG. **4** is a cross-sectional view of the process cartridge taken along a line B-B in FIG. **3**A;

FIG. **5** is a cross-sectional view of the process cartridge taken along a line C-C in FIG. **3**A;

FIG. **6** is a cross-sectional view of the process cartridge taken along a line D-D in FIG. **3**A;

FIG. **7** is a cross-sectional view of the process cartridge taken along a line F-F in FIG. **6**;

FIG. **8**A is a cross-sectional view of the process cartridge taken along a line E-E in FIG. **6**;

FIG. **8**B is a cross-sectional view of the process cartridge taken along the line E-E in FIG. **6**, showing a separated position of a developing unit shown in FIG. **8**A;

FIG. **9** is a cross-sectional view of the image forming apparatus taken along a line G-G in FIG. **2**;

FIG. **10** is a cross-sectional view of the image forming apparatus taken along a line H-H in FIG. **2**;

FIG. **11** is a cross-sectional view of the image forming apparatus taken along a line I-I in FIG. **2**; and

FIG. **12** is a view illustrating how the process cartridge is mounted in and removed from a main casing of the image forming apparatus according to the embodiment.

DETAILED DESCRIPTION

An image forming apparatus **1** according to one embodiment will be described with reference to the accompanying drawings, wherein like parts and components are designated by the same reference numerals to avoid duplicating description. Directions referred to in the following description are based on directions indicated in the drawings.

1. Overall Structure of Image Forming Apparatus

As shown in FIG. **1**, the image forming apparatus **1** is a laser printer. The image forming apparatus **1** includes a main casing **2** formed with an opening **2**A (FIG. **12**); a plurality of (four) process cartridges **3**; a plurality of (four) toner cartridges **18** (FIG. **9**); a scanning unit **4**; a belt unit **5**; a secondary transfer roller **6** as an example of a secondary transfer member; a fixing unit **7**; and a reading unit **26**.

The main casing **2** is box-shaped, and is provided with a cover **8** and a supply tray **9**.

As shown in FIG. **12**, the opening **2**A is positioned at an upper end portion of the main casing **2** to provide communication between an interior and exterior of the main casing **2** in a vertical direction. The opening **2**A allows the plurality of process cartridges **3** to pass therethrough.

As shown in FIG. **1**, the cover **8** is disposed at the upper end portion of the main casing **2**. The cover **8** has a plate shape that is elongated in a front-rear direction (an example of an orthogonal direction). The cover **8** is supported at an upper end portion of the belt unit **5**. The cover **8** is pivotally movable together with the belt unit **5** about an axis of shaft parts **86**A of a pivot member **86** (described later) between an open position opening the opening **2**A (FIG. **12**) and a closed position closing the opening **2**A (FIG. **1**). The pivot axis of the cover **8** (i.e. axis of the shaft parts **86**A) is positioned rearward of the cover **8**.

The supply tray **9** is disposed at a lower end portion of the main casing **2**. The supply tray **9** is configured to accommodate sheets P.

The plurality of process cartridges **3** is detachable from and attachable to the main casing **2**. When attached to the main casing **2**, the four process cartridges **3** are arrayed in the front-rear direction with a space between neighboring process cartridges **3**. Each process cartridge **3** can be detached from the main casing **2** to an outside through the opening **2**A as shown in FIG. **12**. As shown in FIG. **3**A, each of the four process cartridges **3** includes a drum unit **10** and a developing unit **11**.

The drum unit **10** includes a photosensitive drum **12** and a charging roller **13** as an example of a charging member.

The photosensitive drum **12** is positioned at an upper end portion of the drum unit **10**. The photosensitive drum **12** has a cylindrical shape that extends in a left-right direction (an example of an axial direction).

The charging roller **13** is positioned downward of the photosensitive drum **12**. The charging roller **13** is in contact with a lower end portion of the photosensitive drum **12**. The charging roller **13** is configured to charge a surface of the photosensitive drum **12**.

The developing unit **11** is positioned diagonally forward and downward of the photosensitive drum **12**. The developing unit **11** includes a developing roller **15**, a supply roller **16**, and a blade **17**.

The developing roller **15** is positioned at an upper end portion of the developing unit **11**. The developing roller **15** is in contact with a front end portion of the photosensitive drum **12**. The developing roller **15** is configured to supply toner to the photosensitive drum **12**.

The supply roller **16** is positioned diagonally forward and downward of the developing roller **15**. The supply roller **16** is in contact with a lower-front end portion of the developing roller **15**. The supply roller **16** is configured to supply toner to the developing roller **15**.

The blade **17** is positioned diagonally rearward and downward of the developing roller **15**. The blade **17** is in contact with a lower-rear end portion of a roller portion **15**A (described later) of the developing roller **15**. The blade **17** is configured to regulate a thickness of a toner layer formed over a surface of the developing roller **15**.

As shown in FIGS. **2** and **9**, the plurality of toner cartridges **18** are positioned diagonally upward and rightward of the plurality of process cartridges **3**, respectively. The plurality of toner cartridges **18** is detachable from and attachable to the main casing **2**. In a state where the process cartridges **3** and the toner cartridges **18** are attached to the main casing **2**, the toner cartridges **18** are positioned upward of the corresponding process cartridges **3**. Each of the toner cartridges **18** is generally box-shaped having a bottom wall formed in an arcuate shape. Each toner cartridge **18** is configured to accommodate therein toner. Toner accommodated in the toner cartridge **18** is conveyed to the corresponding developing unit **11**.

As shown in FIG. **1**, the scanning unit **4** is positioned downward of the four process cartridges **3**. The scanning unit **4** is configured to irradiate a laser beam L based on image data. The laser beam L is incident on the surface of each photosensitive drum **12**, passing between the developing unit **11** and the corresponding charging roller **13**.

The belt unit **5** is positioned upward of the four process cartridges **3** when the process cartridges **3** are attached to the main casing **2**. The belt unit **5** extends in the front-rear direction. The belt unit **5** includes a first roller **19** positioned at a rear end portion of the belt unit **5**; a second roller **20** positioned at a front end portion of the belt unit **5**; a third roller **21** positioned diagonally forward and downward of the first roller **19**; a transfer belt **22**; and a plurality of (four) primary transfer rollers **23**.

The transfer belt **22** is looped over the first roller **19**, the second roller **20**, and the third roller **21**. The transfer belt **22** has a lower portion that is in contact with the four photosensitive drums **12**. The transfer belt **22** is circularly mov-

able around the first roller **19**, the second roller **20**, and the third roller **21** such that the lower portion of the transfer belt **22** is moved rearward.

The four primary transfer rollers **23** are arrayed in the front-rear direction between the second roller **20** and the third roller **21**, with a space between neighboring primary transfer rollers **23**. The primary transfer rollers **23** are positioned upward of the corresponding photosensitive drums **12**, with the transfer belt **22** interposed therebetween.

The secondary transfer roller **6** is positioned rearward of the first roller **19**. The secondary transfer roller **6** is in contact with a rear end portion (an example of one end in the orthogonal direction) of the transfer belt **22**. The secondary transfer roller **6** nips the transfer belt **22** in cooperation with the first roller **19**.

The fixing unit **7** is positioned upward of the rear end portion of the transfer belt **22** and the secondary transfer roller **6**. That is, the fixing unit **7** is positioned closer to the rear end portion of the transfer belt **22** than to a front end portion of the transfer belt **22** in the front-rear direction. The fixing unit **7** includes a heating roller **24** as an example of a heating body, and a pressure roller **25** as an example of a pressure body in pressure contact with the heating roller **24**.

The reading unit **26** is positioned above the main casing **2**. More specifically, the reading unit **26** is positioned upward of the cover **8** with a gap therebetween. The reading unit **26** is a flat-bed type image scanner. The reading unit **26** is configured to read image data from an original document.

Upon start of an image-forming operation in the image forming apparatus **1**, the scanning unit **4** irradiates the laser beam L, so that the surfaces of the photosensitive drums **12** are exposed to the laser beam L. Thus, electrostatic latent images based on image data are formed on the surfaces of the photosensitive drums **12**, respectively.

Then, toner is supplied onto the electrostatic latent images on the surfaces of the photosensitive drums **12** by the corresponding developing rollers **15**. Thus, toner images are carried on the surfaces of the respective photosensitive drums **12**.

Then, the toner images on the surfaces of the photosensitive drums **12** are transferred onto the transfer belt **22**.

In the meantime, the sheets P are supplied from the supply tray **9** one at a prescribed timing to a position between the transfer belt **22** and the secondary transfer roller **6**. The toner image on the transfer belt **22** is transferred onto the sheet P when the sheet P passes between the transfer belt **22** and the secondary transfer roller **6**.

Subsequently, the sheet P is heated and pressed when the sheet P passes between the heating roller **24** and the pressure roller **25**. Thus, the toner image carried on the sheet P is thermally fixed onto the sheet P.

Then, the sheet P is delivered onto the cover **8**.

2. Process Cartridge

As shown in FIGS. **3**A and **8**A, each of the process cartridges **3** includes the drum unit **10**, the developing unit **11**, and a second toner conveying part **51**.

(1) Drum Unit

As shown in FIGS. **3**A, **3**B, and **5**, the drum unit **10** includes a left side plate **31**L, a right side plate **31**R, a drum cleaner **32**, and a handle **33**.

The left side plate **31**L is positioned at a left end portion of the drum unit **10**. The left side plate **31**L extends both in the vertical direction and in the front-rear direction. The left side plate **31**L includes a support part **35**.

The support part **35** is positioned at an upper end portion of the left side plate **31**L. The support part **35** has a cylindrical shape that extends in the left-right direction. A left end portion of the photosensitive drum **12** is rotatably fitted into the support part **35**.

The right side plate **31**R is positioned at a right end portion of the drum unit **10**. The right side plate **31**R has a configuration the same as that of the left side plate **31**L. A right end portion of the photosensitive drum **12** is rotatably fitted into the support part **35** of the right side plate **31**R.

As shown in FIGS. **6** and **7**, the drum cleaner **32** is positioned rearward of the photosensitive drum **12** and the charging roller **13**. The drum cleaner **32** is positioned between the left side plate **31**L and the right side plate **31**R. The drum cleaner **32** is spaced apart from the right side plate **31**R. A left end portion of the drum cleaner **32** is connected to the left side plate **31**L, while a right end portion of the drum cleaner **32** is connected to the right side plate **31**R through a connecting wall **34** at a lower end portion thereof. The drum cleaner **32** includes an accommodation part **37** having an opening **37**A and an opening **37**B; a blade **38**; an auger screw **36**; and a seal **39**.

The accommodation part **37** has a flattened box shape and is elongated both in the vertical direction and in the left-right direction. The accommodation part **37** has a lower wall **37**C that slopes rearward toward a top side thereof.

The opening **37**A is positioned at an upper end portion of the accommodation part **37**. The opening **37**A penetrates a front wall of the accommodation part **37** in the front-rear direction. The opening **37**A faces a rear portion of a circumferential surface of the photosensitive drum **12**.

The opening **37**B is positioned at a lower-right end portion of the accommodation part **37**. The opening **37**B penetrates the lower wall **37**C of the accommodation part **37**.

The blade **38** is positioned at an upper end portion of the drum cleaner **32**. The blade **38** has a plate shape that is elongated both in the vertical direction and in the left-right direction. The blade **38** is attached to a front surface of the accommodation part **37** on a lower edge portion of the opening **37**A. An upper end portion of the blade **38** is positioned within the opening **37**A and in contact with the rear portion of the circumferential surface of the photosensitive drum **12**.

The auger screw **36** is positioned at a lower end portion of the accommodation part **37**. The auger screw **36** extends in the left-right direction.

The seal **39** is attached to a lower-rear surface of the lower wall **37**C of the accommodation part **37** on an edge portion of the opening **37**B. The seal **39** has a rectangular frame-like shape. The seal **39** surrounds the opening **37**B. The seal **39** is formed of a sponge, for example.

As shown in FIG. **3**A, the handle **33** is positioned at an upper-front end portion of the drum unit **10**. The handle **33** is pivotally movable between an upright position (indicated by dashed lines in FIG. **3**A) extending vertically upward, and an inclined position (indicated by solid lines in FIG. **3**A) inclined forward from the upright position.

(2) Developing Unit

As shown in FIGS. **3**A and **4**, the developing unit **11** is positioned between the left side plate **31**L and the right side plate **31**R. The developing unit **11** is pivotally movable about a support shaft **48** (described later) between a contact position (FIG. **8**A) in which the developing roller **15** is in contact with the photosensitive drum **12**, and a separated position (FIG. **8**B) in which the developing roller **15** is separated from the photosensitive drum **12**.

The following description of the developing unit **11** will be based on the developing unit **11** being in its contact position.

The developing unit **11** includes a frame **40**, the developing roller **15**, the supply roller **16**, the blade **17**, an auger screw **47**, a plurality of seals **46**, and the support shaft **48**.

(2-1) Frame

The frame **40** has a box shape with an upper-rear opening. The frame **40** includes a left side wall **41**L, a right side wall **41**R having an opening **41**A, a lower wall **42**, a front wall **43**, and a rear wall **44**.

The left side wall **41**L is positioned at a left end portion of the developing unit **11**. The left side wall **41**L is positioned rightward of the left side plate **31**L and spaced apart from the left side plate **31**L. The left side wall **41**L extends both in the vertical direction and in the front-rear direction. The left side wall **41**L includes a support part **45**L.

The support part **45**L is positioned between a left end portion of the auger screw **47** and a left end portion of the developing roller **15**. The support part **45**L protrudes rightward from a right surface of the left side wall **41**L. The support part **45**L has a plate shape that extends in the left-right direction.

The right side wall **41**R is positioned at a right end portion of the developing unit **11**. The right side wall **41**R is positioned leftward of the right side plate **31**R and spaced apart from the right side plate **31**R. The right side wall **41**R extends both in the vertical direction and in the front-rear direction. The right side wall **41**R includes a support part **45**R.

The opening **41**A is positioned at a lower-rear end portion of the right side wall **41**R. The opening **41**A penetrates the right side wall **41**R in the left-right direction. The opening **41**A has a circular shape in a side view.

The support part **45**R is positioned between a right end portion of the auger screw **47** and a right end portion of the developing roller **15**. The support part **45**R protrudes leftward from a left surface of the right side wall **41**R. The support part **45**R has a plate shape that extends in the left-right direction.

The lower wall **42** constitutes a lower wall of the developing unit **11**. The lower wall **42** is positioned between the left side wall **41**L and the right side wall **41**R. The lower wall **42** extends both in the left-right direction and in the front-rear direction. A left edge of the lower wall **42** is connected to a lower edge of the left side wall **41**L, while a right edge of the lower wall **42** is connected to a lower edge of the right side wall **41**R.

The front wall **43** constitutes a front wall of the developing unit **11**. The front wall **43** extends upward from a front edge of the lower wall **42**. A left edge of the front wall **43** is connected to a front edge of the left side wall **41**L, while a right edge of the front wall **43** is connected to a front edge of the right side wall **41**R.

The rear wall **44** constitutes a rear wall of the developing unit **11**. The rear wall **44** extends upward from a rear edge of the lower wall **42**. A left edge of the rear wall **44** is connected to a rear edge of the left side wall **41**L, while a right edge of the rear wall **44** is connected to a rear edge of the right side wall **41**R.

(2-2) Developing Roller

The developing roller **15** includes the roller portion **15**A and a shaft **15**B.

The roller portion **15**A constitutes an outer circumferential portion of the developing roller **15** in a radial direction of the developing roller **15**. The roller portion **15**A extends in the left-right direction. The roller portion **15**A has a cylindrical shape.

The shaft **15**B constitutes a center portion of the developing roller **15** in the radial direction of the developing roller **15**. The shaft **15**B extends in the left-right direction. The shaft **15**B has a columnar shape. The shaft **15**B is inserted into an interior of the roller portion **15**A such that an outer circumferential surface of the shaft **15**B is in contact with an inner circumferential surface of the roller portion **15**A. A left end portion of the shaft **15**B protrudes further leftward than a left end face of the roller portion **15**A and is rotatably supported at the left side wall **41**L. Similarly, a right end portion of the shaft **15**B protrudes further rightward than a right end face of the roller portion **15**A and is rotatably supported at the right side wall **41**R.

(2-3) Supply Roller

The supply roller **16** includes a roller portion **16**A and a shaft **16**B.

The roller portion **16**A constitutes an outer circumferential portion of the supply roller **16** in a radial direction of the supply roller **16**. The roller portion **16**A extends in the left-right direction. The roller portion **16**A has a cylindrical shape. The roller portion **16**A is in contact with a lower-front end portion of the roller portion **15**A.

The shaft **16**B constitutes a center portion of the supply roller **16** in the radial direction of the supply roller **16**. The shaft **16**B extends in the left-right direction. The shaft **16**B has a columnar shape. The shaft **16**B is inserted into an interior of the roller portion **16**A such that an outer circumferential surface of the shaft **16**B is in contact with an inner circumferential surface of the roller portion **16**A. A left end portion of the shaft **16**B protrudes further leftward than a left end face of the roller portion **16**A and is rotatably supported at the left side wall **41**L. Similarly, a right end portion of the shaft **16**B protrudes further rightward than a right end face of the roller portion **16**A and is rotatably supported at the right side wall **41**R.

(2-4) Blade

The blade **17** includes a support plate **17**A and a contact part **17**B.

The support plate **17**A has a plate shape that is elongated both in the front-rear direction and in the left-right direction. The support plate **17**A is formed of metal, for example. A rear end portion of the support plate **17**A is supported at an upper end portion of the rear wall **44**.

The contact part **17**B is supported on an upper surface of the support plate **17**A at a front end portion thereof. The contact part **17**B has a plate shape that is elongated in the left-right direction. The contact part **17**B is formed of rubber, for example. The contact part **17**B is in contact with a lower portion of an outer circumferential surface of the developing roller **15**.

(2-5) Auger Screw

The auger screw **47** is positioned rearward of the supply roller **16** and downward of the developing roller **15**. The auger screw **47** extends in the left-right direction.

(2-6) Seal

The plurality of seals **46** includes a seal **46**A that seals a gap between a left end of the support plate **17**A and the support part **45**L; a seal **46**B that seals a gap between the left end of the support plate **17**A and a left end portion of the roller portion **15**A; a seal **46**C that seals a gap between a right end of the support plate **17**A and the support part **45**R; and a seal **46**D that seals a gap between the right end of the support plate **17**A and a right end portion of the roller portion **15**A. The seals **46** each have a plate shape that extends in the left-right direction. The seals **46** are formed of a sponge, for example.

(2-7) Support Shaft

The support shaft **48** is positioned at an upper end portion of the developing unit **11**. The support shaft **48** has a

columnar shape that extends in the left-right direction. The support shaft **48** extends through the upper end portion of the developing unit **11**. A left end portion of the support shaft **48** protrudes further leftward than the left side wall **41**L and is rotatably supported at an upper end portion of the left side plate **31**L. Similarly, a right end portion of the support shaft **48** protrudes further rightward than the right side wall **41**R and is rotatably supported at an upper end portion of the right side plate **31**R.

(3) Second Toner Conveying Part

As shown in FIGS. **6** and **8**A, the second toner conveying part **51** is positioned at a right end portion of the process cartridge **3**. The second toner conveying part **51** is positioned between the right side plate **31**R and the drum cleaner **32**, and is also positioned between the right side plate **31**R and the developing unit **11**. The second toner conveying part **51** includes a third toner conveying part **52**, a fourth toner conveying part **53**, a connecting member **54**, and a screw **58**.

The third toner conveying part **52** is positioned rearward of the photosensitive drum **12**. The third toner conveying part **52** is positioned between the right side plate **31**R and the drum cleaner **32**. The third toner conveying part **52** is supported at the drum unit **10**. The third toner conveying part **52** includes a wall part **55** having a second opening **55**A, a tubular part **56**, and a seal **59**.

The wall part **55** is positioned between an upper-rear end portion of the right side plate **31**R and an upper-rear end portion of the drum cleaner **32**. The wall part **55** has a plate shape that extends in the left-right direction. A right edge of the wall part **55** is connected to a left surface of the right side plate **31**R. A left edge of the wall part **55** is connected to a right surface of the drum cleaner **32**. The wall part **55** slopes forward toward a top side thereof.

The second opening **55**A is positioned at a center portion of the wall part **55** in the left-right direction. The second opening **55**A is positioned opposite the developing roller **15** with respect to the photosensitive drum **12** in the front-rear direction. That is, the second opening **55**A is positioned rearward of the photosensitive drum **12**. Further, the second opening **55**A is positioned further rightward than the developing roller **15** (FIG. **4**). Further, the second opening **55**A is positioned further rightward than a corresponding discharge opening **106**A (described later) (FIG. **2**). The second opening **55**A penetrates the wall part **55**.

The tubular part **56** is positioned downward of the wall part **55**. The tubular part **56** extends downward from an edge of the second opening **55**A on a lower-front surface of the wall part **55**.

The seal **59** is attached to an upper-rear surface of the wall part **55** on an edge portion of the second opening **55**A. The seal **59** has a rectangular frame-like shape. The seal **59** surrounds the second opening **55**A. The seal **59** is formed of a sponge, for example.

As shown in FIGS. **4** and **8**A, the fourth toner conveying part **53** is positioned downward of the photosensitive drum **12**. The fourth toner conveying part **53** extends in the front-rear direction. The fourth toner conveying part **53** is positioned rightward of the charging roller **13** (FIG. **3**A). That is, the fourth toner conveying part **53** overlaps the charging roller **13** when viewed in the left-right direction. The fourth toner conveying part **53** is supported at the developing unit **11**. A front end portion of the fourth toner conveying part **53** is connected to a lower-rear end portion of the right side wall **41**R and is in communication with the opening **41**A. A rear end portion of the fourth toner conveying part **53** is positioned downward of the third toner conveying part **52**. The rear end portion of the fourth toner conveying part **53** is bent upward to extend upward, and faces a lower end portion of the tubular part **56**. A portion of the fourth toner conveying part **53** that extends in the front-rear direction constitutes a second portion of the second toner conveying part **51**.

The screw **58** is positioned inside the fourth toner conveying part **53**. The screw **58** is a coil formed of metal, for example. A front end portion of the screw **58** is connected to a right end portion of the auger screw **47**.

As shown in FIGS. **6** and **8**A, the connecting member **54** is provided to surround a lower end portion of the third toner conveying part **52** and a rear end portion of the fourth toner conveying part **53**. The connecting member **54** is formed of an elastic material such as sponge or rubber, for example. The connecting member **54** has a cylindrical shape. The lower end portion of the third toner conveying part **52** is inserted into an upper end portion of the connecting member **54**. The rear end portion of the fourth toner conveying part **53** is inserted into a lower end portion of the connecting member **54**. With this arrangement, the connecting member **54** connects the fourth toner conveying part **53** to the third toner conveying part **52** such that the fourth toner conveying part **53** is movable relative to the third toner conveying part **52**. The tubular part **56** of the third toner conveying part **52**, a portion of the rear end portion of the fourth toner conveying part **53** that extends upward, and the connecting member **54** constitute a first portion of the second toner conveying part **51**.

3. Main Casing

As shown in FIGS. **2** and **10**, the main casing **2** includes a casing **80** having an opening **80**A; a frame **81**; a plurality of (four) support parts **82**; a plurality of (four) main-casing toner conveying parts **83**; a belt cleaner **93**; a toner discharge part **84**; an accommodation part **85**; and the pivot member **86**.

(1) Casing and Frame

As shown in FIG. **2**, the casing **80** constitutes an exterior of the main casing **2**. The casing **80** has a box shape. The casing **80** is formed of resin, for example. The casing **80** includes a side cover **87**.

The opening **80**A is positioned at an upper-right end portion of the casing **80**. The opening **80**A is positioned rightward of the support parts **82**. The opening **80**A penetrates a right wall of the casing **80** in the left-right direction.

The side cover **87** is positioned at the upper-right end portion of the casing **80**. The side cover **87** has a plate shape that extends in the vertical direction. The side cover **87** is pivotally movable about a lower end thereof between an open position (indicated by dashed lines in FIG. **2**) that opens the opening **80**A and a closed position (indicated by solid lines in FIG. **2**) that closes the opening **80**A.

The frame **81** is disposed inside the casing **80**. The frame **81** is formed of metal, such as stainless steel or steel, for example. The frame **81** includes a left side plate **71**L; a right side plate **71**R having a plurality of (four) insertion holes **71**A and an insertion hole **71**B (FIG. **9**); a lower plate **72**, a left positioning plate **73**L having a plurality of (four) recessed parts **73**A; and a right positioning plate **73**R having a plurality of (four) recessed parts **73**A.

The left side plate **71**L is positioned inside the casing **80** and at a left end portion of the casing **80**. The left side plate **71**L is elongated both in the vertical direction and in the front-rear direction. The left side plate **71**L includes a plurality of (four) main-casing guide parts **74** (FIG. **12**).

As shown in FIG. **12**, the main-casing guide parts **74** are positioned on an inner surface (right surface) of the left side plate **71**L. The main-casing guide parts **74** have a U-shape

in a side view with a top opening. The main-casing guide parts **74** extend in a direction from upper front to lower rear. That is, each of the main-casing guide parts **74** slopes forward toward a top side thereof. Each main-casing guide part **74** receives the support part **35** of the left side plate **31**L. The main-casing guide part **74** guides the support part **35** of the left side plate **31**L into the recessed part **73**A of the left positioning plate **73**L. With this configuration, the main-casing guide parts **74** guide the process cartridges **3** when the process cartridges **3** are mounted in and removed from the main casing **2**. The four main-casing guide parts **74** are arrayed at intervals in the front-rear direction.

The right side plate **71**R is positioned inside the casing **80** and at a right end portion of the casing **80**. The right side plate **71**R is positioned rightward of the left side plate **71**L and spaced apart from the left side plate **71**L. The right side plate **71**R has the same shape as the left side plate **71**L, except that the insertion holes **71**A and the insertion holes **71**B are formed. Each main-casing guide part **74** of the right side plate **71**R receives the support part **35** of the right side plate **31**R. The main-casing guide part **74** of the right side plate **71**R guides the support part **35** of the right side plate **31**R into the recessed part **73**A of the right positioning plate **73**R.

As shown in FIGS. **2** and **9**, the insertion holes **71**A are positioned diagonally upward and rearward of the corresponding process cartridges **3** when viewed in the left-right direction. The plurality of insertion holes **71**A are arrayed at intervals in the front-rear direction. The insertion holes **71**A penetrate the right side plate **71**R in the left-right direction. The insertion holes **71**A have a circular shape in a side view.

As shown in FIG. **9**, the insertion hole **71**B is positioned at a lower-rear end portion of the right side plate **71**R. The insertion hole **71**B penetrates the right side plate **71**R in the left-right direction. The insertion hole **71**B has a circular shape in a side view.

As shown in FIG. **2**, the lower plate **72** is positioned downward of the scanning unit **4**. The lower plate **72** extends in the left-right direction. A left edge of the lower plate **72** is connected to the left side plate **71**L. A right edge of the lower plate **72** is connected to the right side plate **71**R.

The left positioning plate **73**L is positioned between the left side plate **71**L and the scanning unit **4**. The left positioning plate **73**L is elongated both in the vertical direction and in the front-rear direction. A lower end portion of the left positioning plate **73**L is bent leftward and connected to the lower plate **72**.

As shown in FIGS. **2** and **12**, the recessed parts **73**A of the left positioning plate **73**L are positioned at an upper end portion of the left positioning plate **73**L. The recessed parts **73**A are recessed downward from an upper edge of the left positioning plate **73**L. The recessed parts **73**A have a U-shape with a top opening. The four recessed parts **73**A are arrayed at intervals in the front-rear direction.

The right positioning plate **73**R is positioned between the right side plate **71**R and the scanning unit **4**. The right positioning plate **73**R has the same shape as the left positioning plate **73**L.

(2) Toner Cartridge, Support Part, and Main-Casing Toner Conveying Part

As shown in FIGS. **2** and **9**, each of the toner cartridges **18** includes a first agitator **91**, and a first toner conveying part **92** having a first opening **92**A.

The first agitator **91** is positioned inside the toner cartridge **18** at its a lower-rear end portion. The first agitator **91** is configured to convey toner accommodated in the toner cartridge **18** toward the first toner conveying part **92**.

The first toner conveying part **92** is positioned at a lower-front end portion of the toner cartridge **18**. The first toner conveying part **92** extends downward from a front end portion of the toner cartridge **18**. The first toner conveying part **92** has a square cylindrical shape. The first toner conveying part **92** includes a second agitator **92**B.

The first opening **92**A is formed on a rear wall of the first toner conveying part **92** at a lower end portion thereof. The first opening **92**A penetrates the rear wall at the lower end portion of the first toner conveying part **92** in the front-rear direction.

The second agitator **92**B is positioned inside the first toner conveying part **92** at the lower end portion thereof. The second agitator **92**B is configured to convey toner in the first toner conveying part **92** toward the first opening **92**A.

The plurality of support parts **82** is positioned diagonally upward and rightward of the plurality of process cartridges **3**, respectively. Each support part **82** has an arcuate shape that conforms to a part of a lower wall of the toner cartridge **18**.

The plurality of main-casing toner conveying parts **83** is positioned downward of the plurality of support parts **82**, respectively. Each main-casing toner conveying part **83** connects the first toner conveying part **92** and the second toner conveying part **51**. Each main-casing toner conveying part **83** includes a wall part **61** having an opening **61**A, a first part **62**, and a second part **63**.

The wall part **61** is positioned downward of a front end portion of the support part **82**. The wall part **61** extends in the vertical direction. An upper edge of the wall part **61** is connected to a front edge of the support part **82**.

The opening **61**A is formed on the wall part **61** at its lower end portion. The opening **61**A penetrates the wall part **61** in the front-rear direction. The opening **61**A can communicate with the first opening **92**A of the toner cartridge **18**.

The first part **62** is positioned rearward of the wall part **61**. The first part **62** extends diagonally downward and rearward from a rear surface of the wall part **61** on an edge portion of the first opening **92**A. The first part **62** has a square cylindrical shape.

As shown in FIGS. **2** and **10**, the second part **63** extends leftward from a lower end portion of the first part **62**. The second part **63** has a cylindrical shape. The second part **63** includes a wall **64** having a third opening **64**A, and an auger screw **65**.

The wall **64** is positioned at a left end portion of the second part **63** at a lower-front end portion thereof. The wall **64** slopes forward toward a top side thereof. The wall **64** has a plate shape that extends in the left-right direction. The wall **64** includes a seal **66**.

The third opening **64**A is positioned at a center portion of the wall **64**. The third opening **64**A penetrates the wall **64**. The third opening **64**A can communicate with the second opening **55**A of the process cartridge **3**.

The seal **66** is attached to a lower-front surface of the wall **64** on an edge portion of the third opening **64**A. The seal **66** has a rectangular frame-like shape. The seal **66** surrounds the third opening **64**A. The seal **66** is formed of a sponge, for example. The seal **66** contacts the seal **59** of the process cartridge **3**.

The auger screw **65** is positioned inside the second part **63**. The auger screw **65** extends in the left-right direction.

(3) Belt Cleaner, Toner Discharge Part, and Accommodation Part

As shown in FIG. **11**, the belt cleaner **93** is positioned at a front end portion of the belt unit **5**. The belt cleaner **93**

includes an accommodation part **94** having an opening **94**A and an opening **94**B; a blade **95**; and an auger screw **97**.

The accommodation part **94** has a box shape that is elongated in the left-right direction.

The opening **94**A is positioned at an upper end portion of the accommodation part **94**. The opening **94**A penetrates a rear wall of the accommodation part **94** in the front-rear direction. The opening **94**A faces the front end portion of the transfer belt **22**.

The opening **94**B is positioned at a right end portion of the accommodation part **94**. The opening **94**B penetrates a lower wall of the accommodation part **94** in the vertical direction.

The blade **95** is positioned at an upper end portion of the belt cleaner **93**. The blade **95** has a plate shape that is elongated both in the vertical direction and in the left-right direction. The blade **95** is attached to a rear surface of the accommodation part **94** on a lower edge of the opening **94**A. An upper edge of the blade **95** is positioned within the opening **94**A and contacts a front portion of an outer surface of the transfer belt **22**.

The auger screw **97** is positioned inside the accommodation part **94** at a lower end portion thereof. The auger screw **97** extends in the left-right direction.

As shown in FIGS. **2** and **11**, the toner discharge part **84** is positioned between the right positioning plate **73**R and the scanning unit **4**. The toner discharge part **84** includes a main part **101**; an auger screw **105**; a connecting part **102** having an opening **102**A; a plurality of (four) connecting parts **103**; and a connecting part **104**.

The main part **101** is positioned between right end portions of the process cartridges **3** and the lower plate **72**. The main part **101** is elongated in the front-rear direction. The main part **101** has a cylindrical shape.

The auger screw **105** is positioned inside the main part **101**. The auger screw **105** extends in the front-rear direction.

The connecting part **102** is connected to the belt cleaner **93**. The connecting part **102** extends upward from a front end portion of the main part **101**. The connecting part **102** has a cylindrical shape. An upper wall of the connecting part **102** has an arcuate shape that conforms to a shape of a lower wall of the belt cleaner **93**.

The opening **102**A is positioned at an upper end portion of the connecting part **102**. The opening **102**A penetrates the upper wall of the connecting part **102** in the vertical direction. The opening **102**A can communicate with the opening **94**B of the belt cleaner **93**.

The connecting parts **103** are connected to the process cartridges **3**, respectively. The plurality of connecting parts **103** is positioned rearward of the connecting part **102**. The plurality of connecting parts **103** is arrayed at intervals in the front-rear direction. The plurality of connecting parts **103** extends upward from an upper portion of a circumferential wall of the main part **101**. Each connecting part **103** has a cylindrical shape. The connecting part **103** includes a wall part **106** having the discharge opening **106**A.

The wall part **106** is positioned at an upper end portion of the connecting part **103**. The wall part **106** slopes rearward toward a top side thereof. The wall part **106** has a plate shape that extends in the left-right direction. The wall part **106** includes a seal **107**.

The discharge opening **106**A is positioned at a center portion of the wall part **106**. The discharge opening **106**A penetrates the wall part **106**. The discharge opening **106**A can communicate with the opening **37**B of the process cartridge **3**.

The seal **107** is attached to an upper-front surface of the wall part **106** on an edge portion of the discharge opening **106**A. The seal **107** has a rectangular frame-like shape. The seal **107** surrounds the discharge opening **106**A. The seal **107** is formed of a sponge, for example. The seal **107** contacts the seal **39** of the process cartridge **3**.

As shown in FIGS. **9** and **11**, the connecting part **104** is connected to the accommodation part **85**. The connecting part **104** extends downward from a rear end portion of the main part **101**, and is bent rightward at its lower end portion to extend rightward. A right end portion of the connecting part **104** protrudes further rightward than the right side plate **71**R through the insertion hole **71**B formed in the right side plate **71**R. The connecting part **104** has a cylindrical shape.

As shown in FIGS. **2** and **9**, the accommodation part **85** is positioned between a lower end portion of the right side plate **71**R and a lower end portion of a right wall of the casing **80**. The accommodation part **85** has a box shape that is elongated in the front-rear direction. An upper-rear end portion of the accommodation part **85** is in communication with the right end portion of the connecting part **104**.

(4) Pivot Member

As shown in FIGS. **9** and **12**, the pivot member **86** is positioned at an upper-rear end portion of the main casing **2**. The pivot member **86** is fixed to a rear end portion of the belt unit **5**, and is pivotally movably supported at an upper-rear end portion of the left side plate **71**L and an upper-rear end portion of the right side plate **71**R. The pivot member **86** includes a pair of shaft parts **86**A, a pair of arms **86**B, and a support shaft **86**C.

One of the shaft parts **86**A is disposed at a left end portion of the pivot member **86**, while the other of the shaft parts **86**A is disposed at a right end portion of the pivot member **86**. The pair of shaft parts **86**A overlaps the fixing unit **7** when viewed in the left-right direction. The left shaft part **86**A is pivotally movably supported at the upper-rear end portion of the left side plate **71**L. The right shaft part **86**A is pivotally movably supported at the upper-rear end portion of the right side plate **71**R. The shaft parts **86**A have a cylindrical shape that extends in the left-right direction.

One of the arms **86**B is disposed at the left end portion of the pivot member **86**, while the other of the arms **86**B is disposed at a right end portion of the pivot member **86**. The left arm **86**B is positioned leftward of the left side plate **71**L and extends diagonally forward and downward from a peripheral surface of the left shaft part **86**A. The right arm **86**B is positioned rightward of the right side plate **71**R and extends diagonally forward and downward from a peripheral surface of the right shaft part **86**A. The arms **86**B have a plate shape.

The support shaft **86**C has a columnar shape that extends in the left-right direction. The support shaft **86**C extends through the rear end portion of the belt unit **5** in the left-right direction. A left end portion of the support shaft **86**C is connected to a lower-front end portion of the left arm **86**B, while a right end portion of the support shaft **86**C is connected to a lower-front end portion of the right arm **86**B.

The reading unit **26** is connected to the shaft parts **86**A of the pivot member **86** through connecting parts (not shown). Accordingly, the cover **8**, the belt unit **5**, and the reading unit **26** are pivotally movable together about the axis of the shaft parts **86**A of the pivot member **86**.

4. Conveyance of Toner

(1) Toner Supply to Developing Unit

As shown in FIG. **9**, toner accommodated in the toner cartridge **18** is conveyed toward the first toner conveying part **92** as the first agitator **91** rotates. Then, toner conveyed into the first toner conveying part **92** is supplied to the first part **62** of the main-casing toner conveying part **83** through

the first opening **92**A and the opening **61**A as the second agitator **92**B rotates. Toner supplied into the first part **62** falls diagonally rearward and downward inside the first part **62** due to gravity.

Toner fallen diagonally rearward and downward inside the first part **62** is then conveyed leftward inside the second part **63** by the auger screw **65**, as shown in FIG. **2**.

Subsequently, toner conveyed leftward inside the second part **63** is supplied into the third toner conveying part **52** of the second toner conveying part **51** through the third opening **64**A and the second opening **55**A, as shown in FIGS. **8**A and **10**.

Then, toner supplied into the third toner conveying part **52** is supplied to the rear end portion of the fourth toner conveying part **53** through the connecting member **54** due to gravity, as shown in FIG. **8**A. Toner supplied to the fourth toner conveying part **53** is then supplied into the frame **40** through the opening **41**A by the screw **58**.

Then, as shown in FIG. **4**, toner supplied into the frame **40** is conveyed rightward by the auger screw **47**. In this way, toner is supplied into the lower-rear end portion in the frame **40**.

Thereafter, as shown in FIG. **3**A, in the image-forming operation described above, the supply roller **16** supplies toner to the developing roller **15**, and toner carried on the developing roller **15** is supplied onto an electrostatic latent image on the surface of the photosensitive drum **12**.

(2) Collection of Waste Toner

In the above-described image-forming operation, the surface of the photosensitive drum **12** is cleaned by the drum cleaner **32** after a toner image on the surface of the photosensitive drum **12** is transferred onto the transfer belt **22**.

At this time, as shown in FIGS. **6** and **7**, waste toner remaining on the surface of the photosensitive drum **12** can be scraped off by the blade **38** of the drum cleaner **32**, and is accommodated in the accommodation part **37**.

The waste toner accommodated in the accommodation part **37** is conveyed rightward inside the accommodation part **37** by the auger screw **36**.

Then, as shown in FIG. **11**, the waste toner in the accommodation part **37** is supplied into the corresponding connecting part **103** of the toner discharge part **84** through the opening **37**B and the discharge opening **106**A.

The waste toner supplied into the connecting part **103** falls downward inside the connecting part **103** due to gravity to be supplied into the main part **101**. The waste toner supplied into the main part **101** is conveyed rearward inside the main part **101** by the auger screw **105**.

Thereafter, as shown in FIGS. **9** and **11**, the waste toner is accommodated in the accommodation part **85** through the connecting part **104**.

Further, in the above-described image-forming operation, waste toner remaining on the surface of the transfer belt **22** is also cleaned by the belt cleaner **93**, and is accommodated in the accommodation part **85** sequentially through the connecting part **102**, the main part **101**, and the connecting part **104**.

5. Mounting and Removing of Process Cartridge

Next, operations for mounting and removing the process cartridges **3** relative to the main casing **2** will be described.

When the process cartridges **3** have been mounted in the main casing **2** as shown in FIGS. **2** and **10**, the seal **59** of each process cartridge **3** is in contact with the seal **66** of the corresponding main-casing toner conveying part **83**. That is, the second opening **55**A of the process cartridge **3** is in communication with the third opening **64**A of the main-casing toner conveying part **83**. In other words, the second opening **55**A of the process cartridge **3** is in communication with the first opening **92**A of the corresponding toner cartridge **18** through the main-casing toner conveying part **83**. Further, the seal **39** of the process cartridge **3** is in contact with the seal **107** of the corresponding connecting part **103** of the toner discharge part **84**. That is, communication between the opening **37**B of the process cartridge **3** and the discharge opening **106**A of the toner discharge part **84** is provided.

At this time, the process cartridge **3** is in its first position.

To remove any of the process cartridges **3** from the main casing **2**, a user first pivotally moves the process cartridge **3** clockwise in a right side view about a rotational axis of the photosensitive drum **12**, as shown in FIG. **12**.

Through this movement, the seal **59** of the process cartridge **3** is separated from the seal **66** of the corresponding main-casing toner conveying part **83** while moving rearward and downward. Accordingly, communication between the second opening **55**A of the process cartridge **3** and the third opening **64**A of the main-casing toner conveying part **83** is interrupted. That is, communication between the second opening **55**A of the process cartridge **3** and the first opening **92**A of the corresponding toner cartridge **18** is interrupted. Further, the seal **39** of the process cartridge **3** is separated forward from the seal **107** of the corresponding connecting part **103** of the toner discharge part **84**. Accordingly, communication between the opening **37**B of the process cartridge **3** and the discharge opening **106**A of the toner discharge part **84** is interrupted.

At this time, the process cartridge **3** is in its second position.

Then, the user pulls the process cartridge **3** diagonally upward and forward from the main casing **2**. The process cartridge **3** is moved diagonally upward and forward along the main-casing guide parts **74**, and separated from the main casing **2** through the opening **2**A.

Through this operation, the process cartridge **3** can be completely removed from the main casing **2**.

To mount the process cartridge **3** in the main casing **2**, the user mounts the process cartridge **3** in the main casing **2** by performing the operation to remove the process cartridge **3** from the main casing **2** described above in reverse.

That is, the user inserts the process cartridge **3** into the main casing **2** through the opening **2**A. Then, the process cartridge **3** moves diagonally rearward and downward along the main-casing guide parts **74**. With this movement, the support parts **35** of the process cartridge **3** are fitted into the recessed parts **73**A of the left positioning plate **73**L and the right positioning plate **73**R.

Next, the user pivotally moves the process cartridge **3** counterclockwise in a right side view about the rotational axis of the photosensitive drum **12**.

Then, as shown in FIG. **10**, the seal **59** of the process cartridge **3** contacts the seal **66** of the corresponding main-casing toner conveying part **83**, and the seal **39** of the process cartridge **3** contacts the seal **107** of the corresponding connecting part **103** of the toner discharge part **84**.

Through this operation, the process cartridge **3** can be completely mounted in the main casing **2**.

6. Operational Advantages

(1) According to the image forming apparatus **1**, as shown in FIGS. **2** and **9**, the main-casing toner conveying part **83** that supplies toner accommodated in the toner cartridge **18** to the process cartridge **3** is disposed diagonally upward and rearward of the process cartridge **3**.

Further, as shown in FIG. **8**A, the process cartridge **3** has the second opening **55**A that communicates with the third

opening **64**A of the main-casing toner conveying part **83**. The second opening **55**A is positioned opposite the developing unit **11** relative to the photosensitive drum **12**. That is, the second opening **55**A is positioned at the rear end portion of the process cartridge **3**.

Accordingly, as shown in FIG. **12**, in a state where the opening **2**A is exposed, the process cartridge **3** can be mounted in and removed from the main casing **2** so as to pass forward of the main-casing toner conveying part **83** without interfering with the main-casing toner conveying part **83**, by manipulating the process cartridge **3** from a front side of the main casing **2**.

As a result, the process cartridge **3** can be smoothly mounted in and removed from the main casing **2** from an upper-front side thereof despite the configuration in which the toner cartridge **18** is positioned further upward than the process cartridge **3**.

Further, according to the image forming apparatus **1**, as shown in FIG. **12**, the shaft parts **86**A are disposed at positions overlapping the fixing unit **7** when viewed in the left-right direction, and the cover **8** and the belt unit **5** are integrally pivotally moved upward about the axis of the shaft parts **86**A of the pivot member **86** to open the opening **2**A.

Accordingly, the opening **2**A can be exposed through one action, and thus, the process cartridge **3** can be more smoothly mounted in and removed from the main casing **2**.

(2) According to the image forming apparatus **1**, as shown in FIG. **8**A, the fourth toner conveying part **53** of the second toner conveying part **51** is disposed downward of the photosensitive drum **12**.

Accordingly, the fourth toner conveying part **53** can be efficiently disposed by using a space downward of the photosensitive drum **12**.

(3) According to the image forming apparatus **1**, as shown in FIGS. **3**A and **8**A, the fourth toner conveying part **53** of the second toner conveying part **51** overlaps the charging roller **13** when viewed in the left-right direction.

Accordingly, the fourth toner conveying part **53** can be efficiently disposed by using a space rightward of the charging roller **13**.

(4) According to the image forming apparatus **1**, as shown in FIGS. **4** and **8**A, the second opening **55**A of the second toner conveying part **51** is positioned further rightward than the developing roller **15**.

Accordingly, toner can be supplied to the process cartridge **3** at a position outward of the developing roller **15** in the left-right direction.

(5) According to the image forming apparatus **1**, as shown in FIGS. **8**A and **8**B, the developing unit **11** is pivotally movable relative to the drum unit **10** between the contact position and the separated position. Further, the second toner conveying part **51** includes the third toner conveying part **52** that has the second opening **55**A and is supported at the drum unit **10**, and the fourth toner conveying part **53** that is connected to the developing unit **11** and is movable relative to the third toner conveying part **52**.

Accordingly, in a state where the second toner conveying part **51** is connected to the developing unit **11**, the developing unit **11** can move between the contact position and the separated position.

(6) According to the image forming apparatus **1**, as shown in FIGS. **8**A and **8**B, the second toner conveying part **51** includes the connecting member **54** that connects the third toner conveying part **52** and the fourth toner conveying part **53**.

Accordingly, the third toner conveying part **52** and the fourth toner conveying part **53** can be reliably connected to each other by the connecting member **54**.

As a result, toner can be reliably conveyed inside the second toner conveying part **51**.

(7) According to the image forming apparatus **1**, the connecting member **54** is formed of a sponge.

Accordingly, as shown in FIGS. **8**A and **8**B, when the developing unit **11** moves between the contact position and the separated position, the connecting member **54** can be elastically deformable to follow the movement of the fourth toner conveying part **53** by the elasticity of the sponge.

As a result, the third toner conveying part **52** and the fourth toner conveying part **53** can be more reliably connected to each other by the connecting member **54**.

(8) According to the image forming apparatus **1**, as shown in FIGS. **10** and **12**, the process cartridge **3** can pivotally move inside the casing **80** about the rotational axis of the photosensitive drum **12** between the first position providing communication between the third opening **64**A of the main-casing toner conveying part **83** and the second opening **55**A, and the second position interrupting communication between the third opening **64**A of the main-casing toner conveying part **83** and the second opening **55**A.

Accordingly, the process cartridge **3** can be removed from the main casing **2** after communication between the third opening **64**A of the main-casing toner conveying part **83** and the second opening **55**A is interrupted by placing the process cartridge **3** in the second position inside the main casing **2**.

Further, when the process cartridge **3** is mounted in the main casing **2**, the process cartridge **3** is placed in the first position to allow the second opening **55**A to communicate with the third opening **64**A of the main-casing toner conveying part **83** after the process cartridge **3** is inserted into the main casing **2**.

As a result, the process cartridge **3** can be more smoothly mounted in and removed from the main casing **2** in a state where the third opening **64**A of the main-casing toner conveying part **83** is out of communication with the second opening **55**A.

(9) According to the image forming apparatus **1**, as shown in FIG. **12**, the main casing **2** includes the main-casing guide parts **74** that slope forward toward top sides thereof. The process cartridge **3** is guided by the main-casing guide parts **74** when mounted in and removed from the main casing **2**.

Accordingly, the process cartridges **3** can be reliably mounted in and removed from the main casing **2** without interfering with the main-casing toner conveying part **83** as the main-casing guide parts **74** guide the process cartridge **3** so that the process cartridge **3** passes in front of the main-casing toner conveying part **83**.

As a result, the process cartridge **3** can be more smoothly mounted in and removed from the main casing **2**.

(10) According to the image forming apparatus **1**, as shown in FIG. **2**, the main casing **2** includes the main-casing toner conveying part **83** that connects the first toner conveying part **92** of the toner cartridge **18** and the second toner conveying part **51** of the process cartridge **3**.

Accordingly, even if the toner cartridge **18** is disposed away from the process cartridge **3**, the toner cartridge **18** can be connected to the process cartridge **3** by the main-casing toner conveying part **83**.

As a result, degree of freedom in layout of the toner cartridge **18** and the process cartridge **3** can be enhanced.

(11) According to the image forming apparatus **1**, as shown in FIG. **10**, the main-casing toner conveying part **83**

includes the wall **64** having the third opening **64**A that faces the second opening **55**A. The wall **64** slopes forward toward a top side thereof.

Accordingly, communication between the second opening **55**A and the third opening **64**A can be easily interrupted by moving the second opening **55**A diagonally rearward and downward.

Specifically, in the process cartridge **3**, the second opening **55**A is positioned at an upper-rear end portion of the process cartridge **3**. Hence, the second opening **55**A can be moved diagonally rearward and downward by pivotally moving the process cartridge **3** clockwise in a right side view. Consequently, communication between the second opening **55**A and the third opening **64**A can be easily interrupted.

Further, as shown in FIG. **12**, the main-casing guide parts **74** that guide mounting and removing of the process cartridge **3** relative to the main casing **2** extends in a direction from upper front to lower rear. That is, a contacting direction between the seal **59** of the process cartridge **3** and the seal **66** of the main-casing toner conveying part **83** is substantially perpendicular to a mounting-removing direction of the process cartridge **3**.

Accordingly, in a state where the seal **59** of the process cartridge **3** is in contact with the seal **66** of the main-casing toner conveying part **83**, the process cartridge **3** cannot be moved diagonally upward and forward due to friction between the seal **59** and the seal **66**.

However, the seal **59** can be easily separated from the seal **66** by pivotally moving the process cartridge **3** clockwise in a right side view. Thus, the process cartridge **3** can smoothly be removed from and mounted in the main casing **2**.

(12) According to the image forming apparatus **1**, as shown in FIG. **11**, the main casing **2** includes the toner discharge part **84** connected to the drum cleaners **32**. The toner discharge part **84** has the discharge openings **106**A. The discharge opening **106**A is positioned opposite the corresponding developing roller **15** with respect to the corresponding photosensitive drum **12** in the front-rear direction. In other words, the discharge opening **106**A is positioned diagonally rearward and downward of the corresponding photosensitive drum **12**.

Accordingly, connection between the drum cleaners **32** and the toner discharge part **84** can be easily interrupted by moving the corresponding process cartridges **3** forward.

As a result, the process cartridge **3** can be smoothly mounted in and removed from the main casing **2**.

(13) According to the image forming apparatus **1**, as shown in FIGS. **2** and **11**, the second opening **55**A is positioned further rightward than the discharge opening **106**A.

Accordingly, toner can be supplied to the process cartridge **3** at a position outward of the discharge opening **106**A in the left-right direction.

7. Variations

In the above-described embodiment, the secondary transfer roller **6** is exemplified as the secondary transfer member. However, an endless belt may be employed in place of the secondary transfer roller **6**.

In the above-described embodiment, the charging roller **13** is exemplified as the charging member. However, a non-contact type charger that does not require contact with the photosensitive drum **12**, such as a scorotron charger, may be used in place of the charging roller **13**.

While the description has been made in detail with reference to the embodiments thereof, it would be apparent to those skilled in the art that many modifications and variations may be made therein without departing from the spirit of the disclosure.

What is claimed is:

1. An image forming apparatus comprising:

a main casing having an opening, the main casing including a cover configured to pivotally move about a pivot axis to open and close the opening;

a process cartridge detachably mountable in the main casing, the process cartridge including a photosensitive drum and a developing roller;

a transfer belt positioned upward of the process cartridge and in contact with the photosensitive drum when the process cartridge has been mounted in the main casing, the transfer belt having one end and another end in an orthogonal direction orthogonal to a vertical direction and an axial direction of the photosensitive drum, the pivot axis being positioned closer to the one end of the transfer belt than to the another end of the transfer belt in the orthogonal direction;

a toner cartridge configured to accommodate toner to be supplied to the process cartridge and detachably mountable in the main casing, the toner cartridge being positioned upward of the process cartridge when the process cartridge and the toner cartridge have been mounted in the main casing;

a secondary transfer member in contact with the one end of the transfer belt;

a fixing unit including a heating body and a pressure body, the fixing unit being positioned closer to the one end of the transfer belt than to the another end of the transfer belt in the orthogonal direction;

a first toner conveying part provided at the toner cartridge and having a first opening; and

a second toner conveying part provided at the process cartridge and having a second opening configured to communicate with the first opening, the second opening being positioned opposite the developing roller with respect to the photosensitive drum in the orthogonal direction.

2. The image forming apparatus according to claim **1**, wherein the second toner conveying part includes:

a first portion extending downward from the second opening and having a lower end portion; and

a second portion extending in the orthogonal direction from the lower end portion of the first portion, the second portion being positioned downward of the photosensitive drum.

3. The image forming apparatus according to claim **2**, wherein the process cartridge further includes a charging member configured to charge a surface of the photosensitive drum, and

wherein the second portion of the second toner conveying part overlaps the charging member when viewed in the axial direction.

4. The image forming apparatus according to claim **1**, wherein the second opening of the second toner conveying part is positioned outward of the developing roller in the axial direction.

5. The image forming apparatus according to claim **1**, wherein the process cartridge comprises:

a drum unit supporting the photosensitive drum; and

a developing unit supporting the developing roller, the developing unit being pivotally movable between a contact position where the developing roller is in contact with the photosensitive drum and a separated

position where the developing roller is separated from the photosensitive drum, and

wherein the second toner conveying part comprises:

a third toner conveying part supported at the drum unit, the second opening being formed in the third toner conveying part; and

a fourth toner conveying part supported at the developing unit, the fourth toner conveying part connecting the developing unit and the third toner conveying part, the fourth toner conveying part being movable relative to the third toner conveying part.

6. The image forming apparatus according to claim **5**, wherein the second toner conveying part further comprises a connecting member connecting the third toner conveying part and the fourth toner conveying part.

7. The image forming apparatus according to claim **6**, wherein the connecting member is formed of a sponge.

8. The image forming apparatus according to claim **1**, wherein the process cartridge is pivotally movable inside the main casing about an axis of the photosensitive drum between a first position providing communication between the first opening and the second opening and a second position interrupting communication between the first opening and the second opening.

9. The image forming apparatus according to claim **1**, wherein the main casing includes a plurality of main-casing guide parts configured to guide the process cartridge when the process cartridge is mounted in and removed from the main casing,

wherein the orthogonal direction is a direction from the one end of the transfer belt toward the another end of the transfer belt, and

wherein each of the plurality of main-casing guide parts slopes upward in the orthogonal direction.

10. The image forming apparatus according to claim **9**, wherein the main casing includes a main-casing toner conveying part connecting the first toner conveying part and the second toner conveying part.

11. The image forming apparatus according to claim **10**, wherein the main-casing toner conveying part includes a wall having a third opening facing the second opening, the wall sloping upward in the orthogonal direction.

12. The image forming apparatus according to claim **1**, wherein the process cartridge further includes a drum cleaner in contact with the photosensitive drum, and

wherein the main casing includes a toner discharge part connected to the drum cleaner, the toner discharge part having a discharge opening positioned opposite the developing roller with respect to the photosensitive drum in the orthogonal direction.

13. The image forming apparatus according to claim **12**, wherein the second opening is positioned outward of the discharge opening in the axial direction.

14. A process cartridge detachably mountable in an image forming apparatus and comprising a developing roller and a photosensitive drum, the image forming apparatus comprising:

a main casing having an opening, the main casing including a cover configured to pivotally move about a pivot axis to open and close the opening;

a transfer belt positioned upward of the process cartridge and in contact with the photosensitive drum when the process cartridge has been mounted in the main casing, the transfer belt having one end and another end in an orthogonal direction orthogonal to a vertical direction and an axial direction of the photosensitive drum, the pivot axis being positioned closer to the one end of the transfer belt than to the another end of the transfer belt in the orthogonal direction;

a toner cartridge configured to accommodate toner to be supplied to the process cartridge and detachably mountable in the main casing, the toner cartridge being positioned upward of the process cartridge when the process cartridge and the toner cartridge have been mounted in the main casing, the toner cartridge including a first toner conveying part having a first opening;

a secondary transfer member in contact with the one end of the transfer belt; and

a fixing unit including a heating body and a pressure body, the fixing unit being positioned closer to the one end of the transfer belt than to the another end of the transfer belt in the orthogonal direction,

the process cartridge detachably mountable in the main casing and further comprising a second toner conveying part having a second opening, the second opening being configured to communicate with the first opening and positioned opposite the developing roller with respect to the photosensitive drum.

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